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Yuasa

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(54) **IMAGE FORMING APPARATUS WITH LUBRICANT SUPPLY**

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G03G 21/00 (2006.01)
G03G 15/16 (2006.01)

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CPC ***G03G 21/0094*** (2013.01); ***G03G 15/161*** (2013.01); *G03G 2215/1661* (2013.01)

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CPC G03G 15/161; G03G 21/0011; G03G 21/0076; G03G 21/0094; G03G 2216/1661; G03G 2221/001; G03G 2221/0026; G03G 2215/1661
See application file for complete search history.

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(57) **ABSTRACT**

An image forming apparatus includes an intermediate transfer belt, a driving source commonly and rotationally driving the intermediate transfer belt and a second image carrier, a first cleaning blade rubbing at a first rubbing position, and a second cleaning blade rubbing a second image rubbing position. The image forming apparatus includes a lubricant supplying portion capable of supplying lubricant to the first or second rubbing position, a load detecting portion detecting a driving load of the driving source, and a control portion capable of executing a lubricant supplying mode of supplying lubricant to either one of the first and second rubbing positions on a basis of processing contents of a most recent predetermined number of times of image forming operations in a case where the driving load detected by the load detecting portion exceeds a predetermined value.

11 Claims, 11 Drawing Sheets

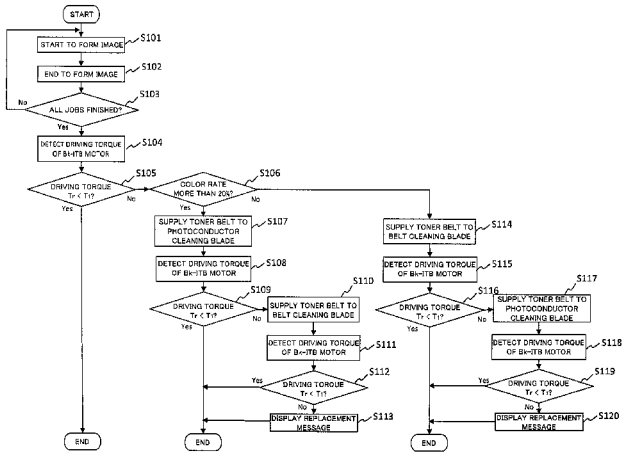

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FIG.1

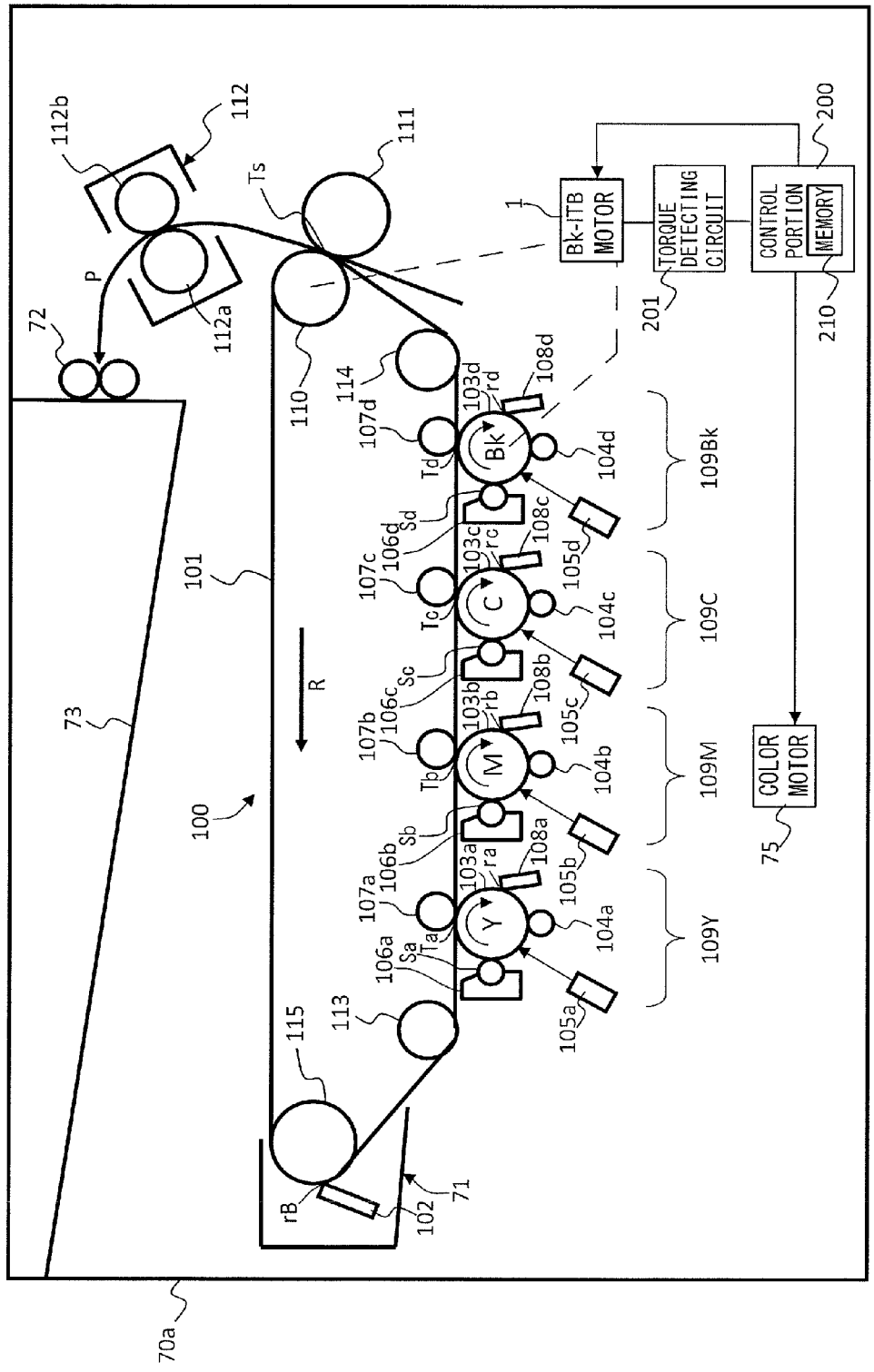
70
70a
72
73
100
101
110
111
112
112a
112b
113
114
115
71
102
rB
P
Ts
R
Bk
C
M
Y
Ta
Tb
Tc
Td
Sa
Sb
Sc
Sd
ra
rb
rc
rd
103a
103b
103c
103d
104a
104b
104c
104d
105a
105b
105c
105d
106a
106b
106c
106d
107a
107b
107c
107d
108a
108b
108c
108d
109Y
109M
109C
109Bk
1
Bk-ITB MOTOR
TORQUE DETECTING CIRCUIT
201
200
CONTROL PORTION
MEMORY
210
COLOR MOTOR
75

FIG.2

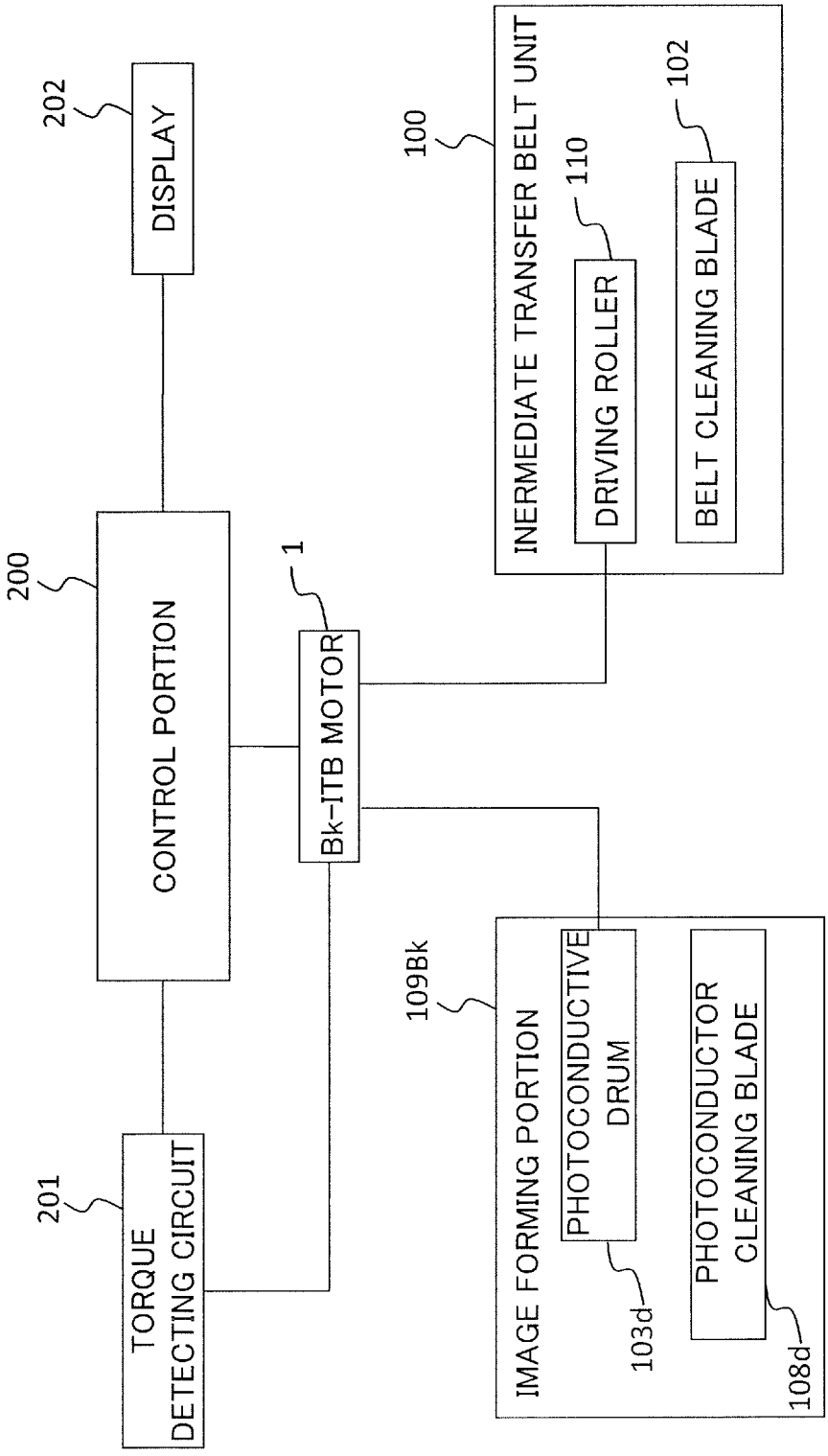
202
DISPLAY
100
INERMEDIATE TRANSFER BELT UNIT
110
DRIVING ROLLER
102
BELT CLEANING BLADE
200
CONTROL PORTION
1
Bk-ITB MOTOR
109Bk
IMAGE FORMING PORTION
PHOTOCONDUCTIVE DRUM
103d
PHOTOCONDUCTOR CLEANING BLADE
108d
201
TORQUE DETECTING CIRCUIT

FIG.3A

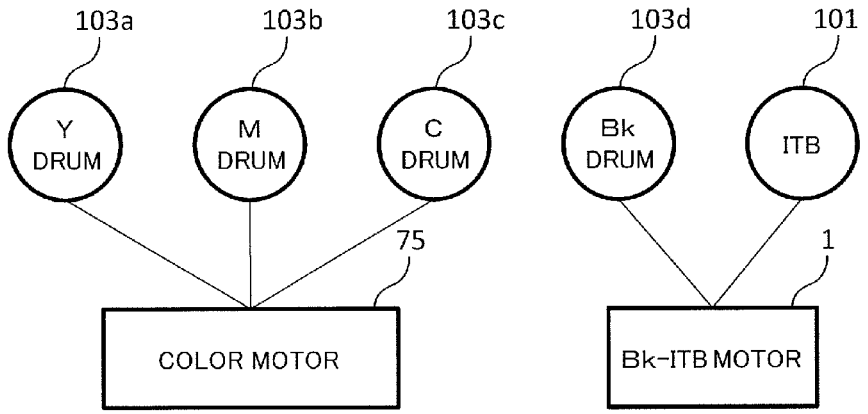
103a
103b
103c
103d
101
Y DRUM
M DRUM
C DRUM
Bk DRUM
ITB
75
1
COLOR MOTOR
Bk-ITB MOTOR

FIG.3B

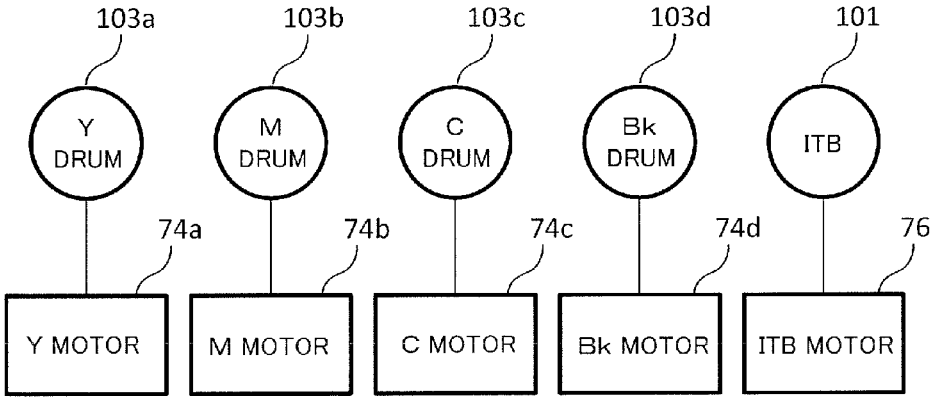
103a
103b
103c
103d
101
Y DRUM
M DRUM
C DRUM
Bk DRUM
ITB
74a
74b
74c
74d
76
Y MOTOR
M MOTOR
C MOTOR
Bk MOTOR
ITB MOTOR

FIG.4A

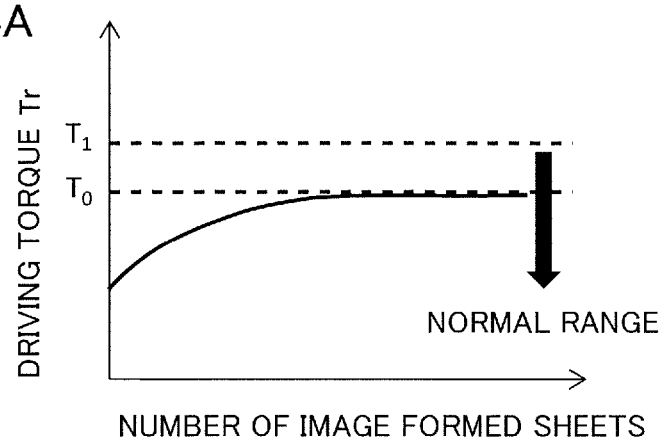

FIG.4B

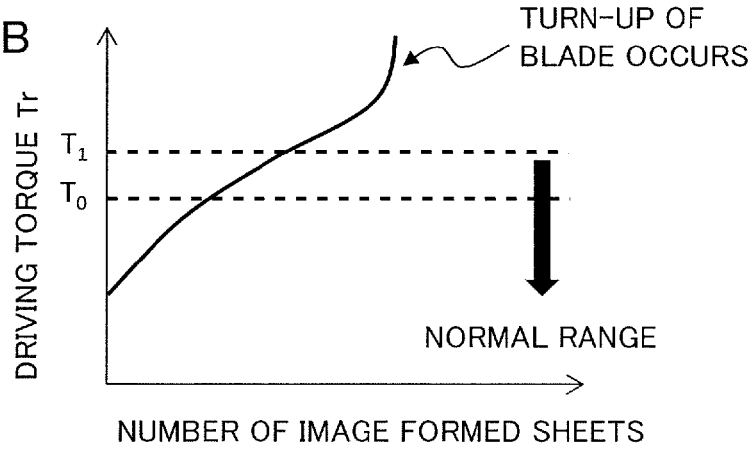

FIG.4C

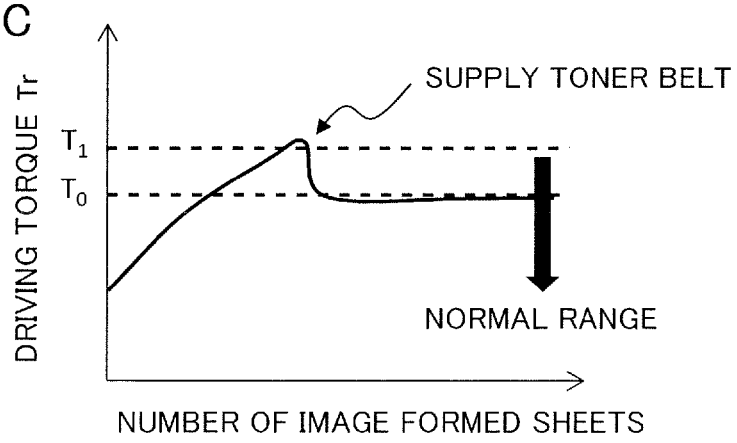

FIG.5

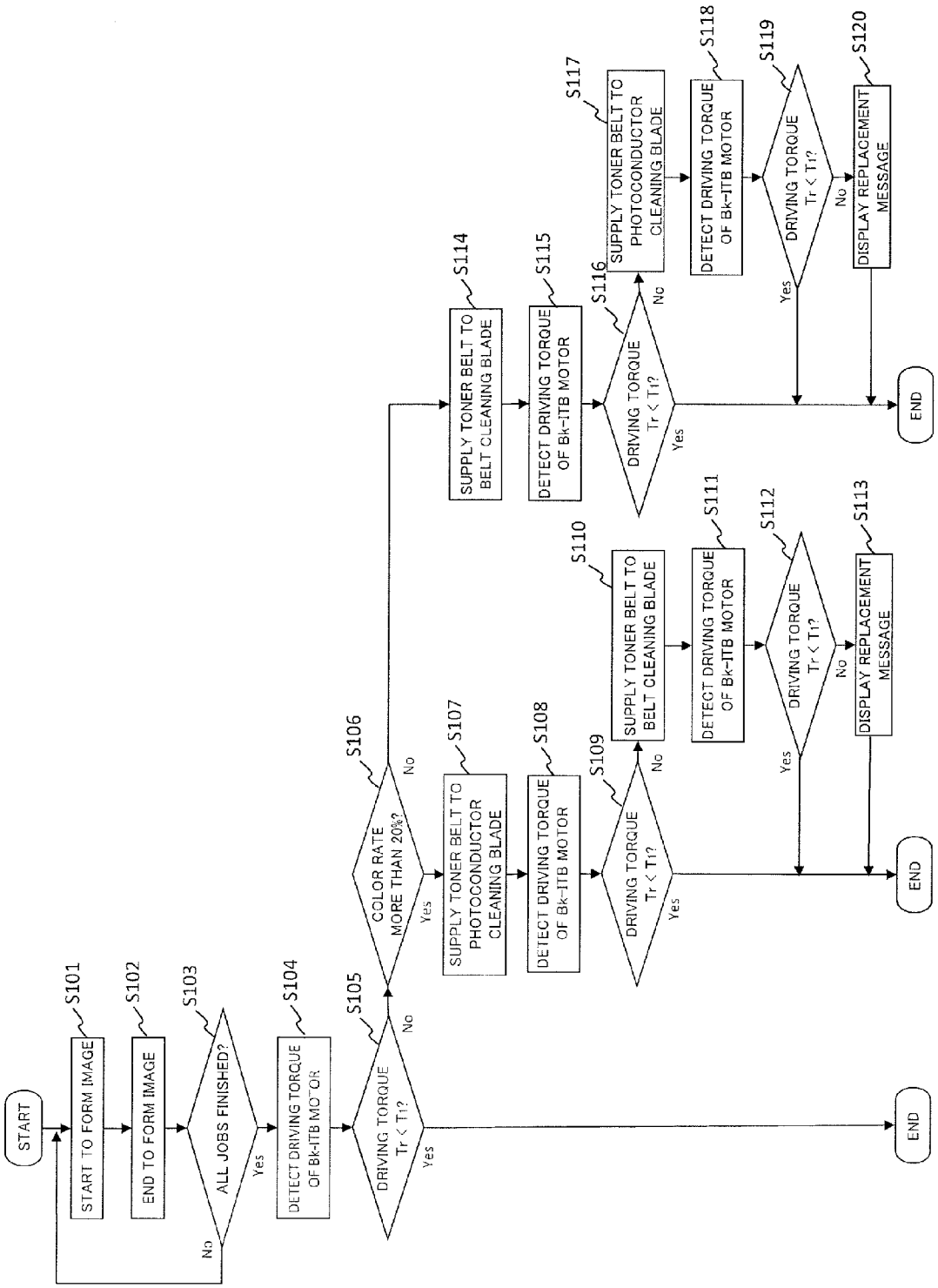
START
START TO FORM IMAGE
S101
END TO FORM IMAGE
S102
ALL JOBS FINISHED?
S103
No
Yes
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S104
DRIVING TORQUE Tr < T1?
S105
Yes
No
END
COLOR RATE MORE THAN 20%?
S106
Yes
No
SUPPLY TONER BELT TO PHOTOCONDUCTOR CLEANING BLADE
S107
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S108
DRIVING TORQUE Tr < T1?
S109
Yes
No
END
SUPPLY TONER BELT TO BELT CLEANING BLADE
S110
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S111
DRIVING TORQUE Tr < T1?
S112
Yes
No
DISPLAY REPLACEMENT MESSAGE
S113
END
SUPPLY TONER BELT TO BELT CLEANING BLADE
S114
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S115
DRIVING TORQUE Tr < T1?
S116
Yes
No
SUPPLY TONER BELT TO PHOTOCONDUCTOR CLEANING BLADE
S117
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S118
DRIVING TORQUE Tr < T1?
S119
Yes
No
DISPLAY REPLACEMENT MESSAGE
S120
END

FIG.6

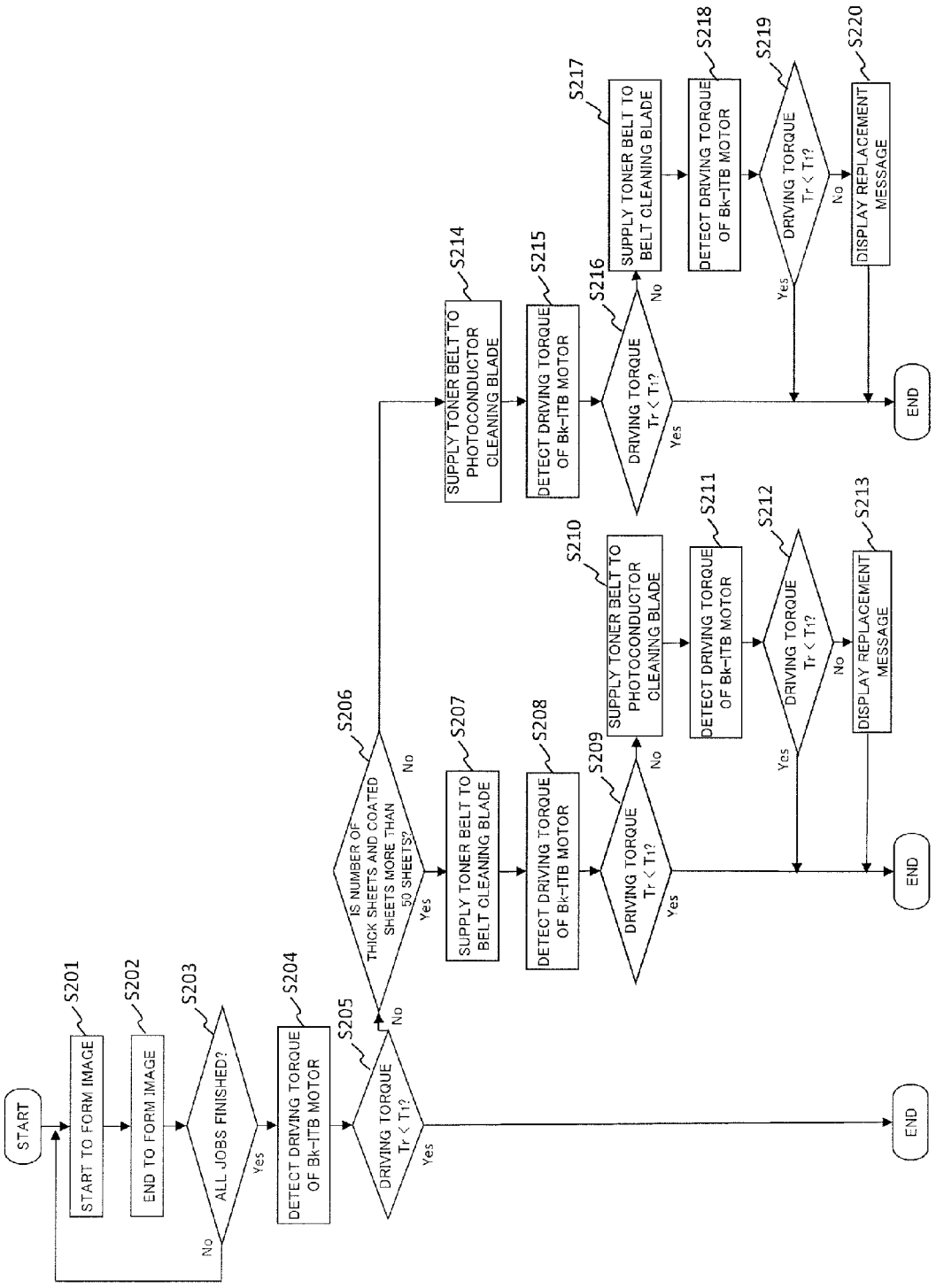
START
S201
START TO FORM IMAGE
S202
END TO FORM IMAGE
S203
ALL JOBS FINISHED?
No
Yes
S204
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S205
DRIVING TORQUE Tr < T1?
Yes
No
END
S206
IS NUMBER OF THICK SHEETS AND COATED SHEETS MORE THAN 50 SHEETS?
Yes
No
S207
SUPPLY TONER BELT TO BELT CLEANING BLADE
S208
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S209
DRIVING TORQUE Tr < T1?
Yes
No
END
S210
SUPPLY TONER BELT TO PHOTOCONDUCTOR CLEANING BLADE
S211
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S212
DRIVING TORQUE Tr < T1?
Yes
No
S213
DISPLAY REPLACEMENT MESSAGE
END
S214
SUPPLY TONER BELT TO PHOTOCONDUCTOR CLEANING BLADE
S215
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S216
DRIVING TORQUE Tr < T1?
Yes
No
S217
SUPPLY TONER BELT TO BELT CLEANING BLADE
S218
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S219
DRIVING TORQUE Tr < T1?
Yes
No
S220
DISPLAY REPLACEMENT MESSAGE
END

FIG.7

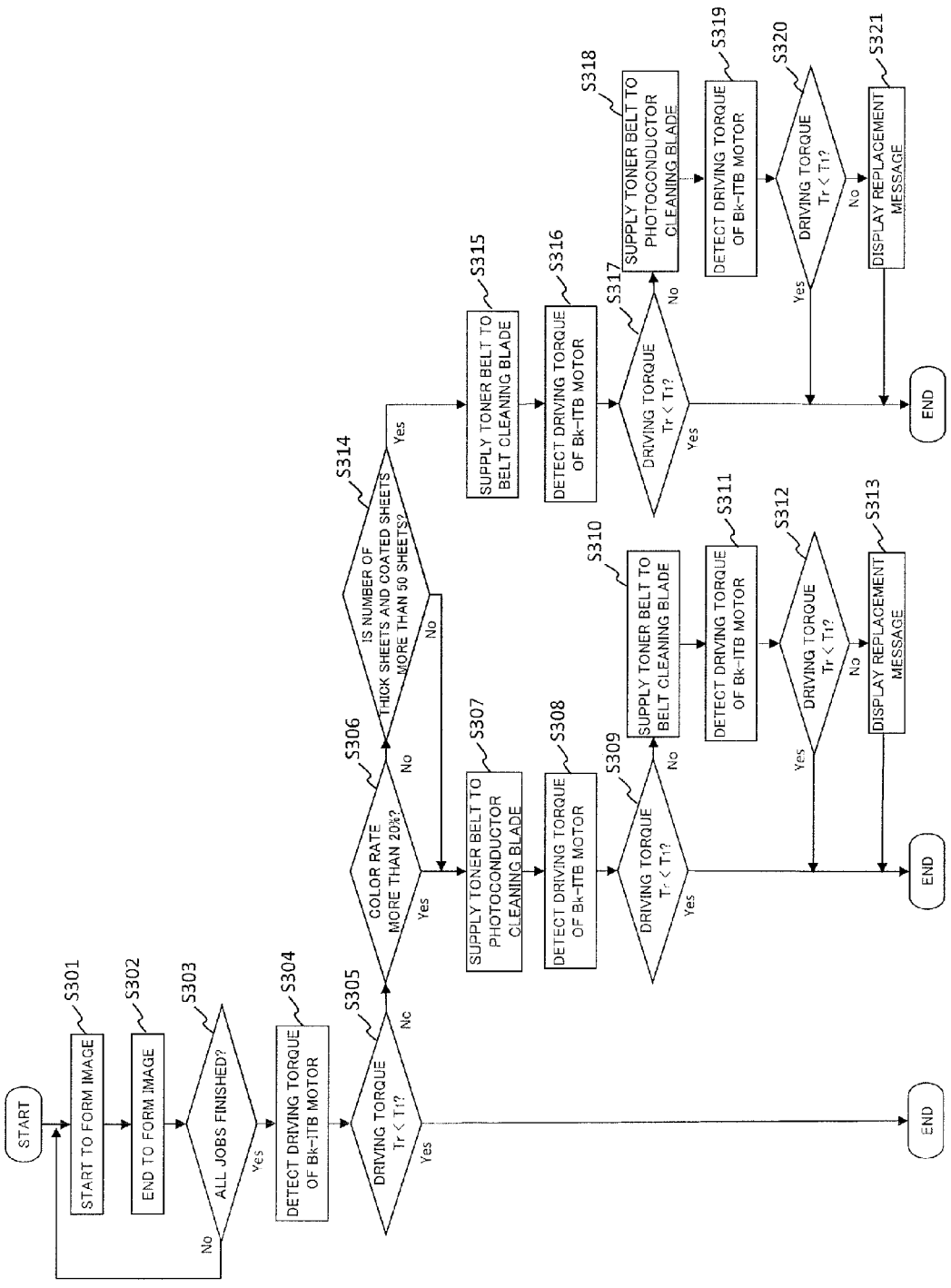
START
START TO FORM IMAGE
S301
END TO FORM IMAGE
S302
ALL JOBS FINISHED?
S303
No
Yes
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S304
DRIVING TORQUE Tr < T1?
S305
Yes
No
END
COLOR RATE MORE THAN 20%?
S306
Yes
No
SUPPLY TONER BELT TO PHOTOCONDUCTOR CLEANING BLADE
S307
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S308
DRIVING TORQUE Tr < T1?
S309
Yes
No
END
SUPPLY TONER BELT TO BELT CLEANING BLADE
S310
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S311
DRIVING TORQUE Tr < T1?
S312
Yes
No
DISPLAY REPLACEMENT MESSAGE
S313
END
IS NUMBER OF THICK SHEETS AND COATED SHEETS MORE THAN 50 SHEETS?
S314
Yes
No
SUPPLY TONER BELT TO BELT CLEANING BLADE
S315
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S316
DRIVING TORQUE Tr < T1?
S317
Yes
No
END
SUPPLY TONER BELT TO PHOTOCONDUCTOR CLEANING BLADE
S318
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S319
DRIVING TORQUE Tr < T1?
S320
Yes
No
DISPLAY REPLACEMENT MESSAGE
S321
END

FIG.8

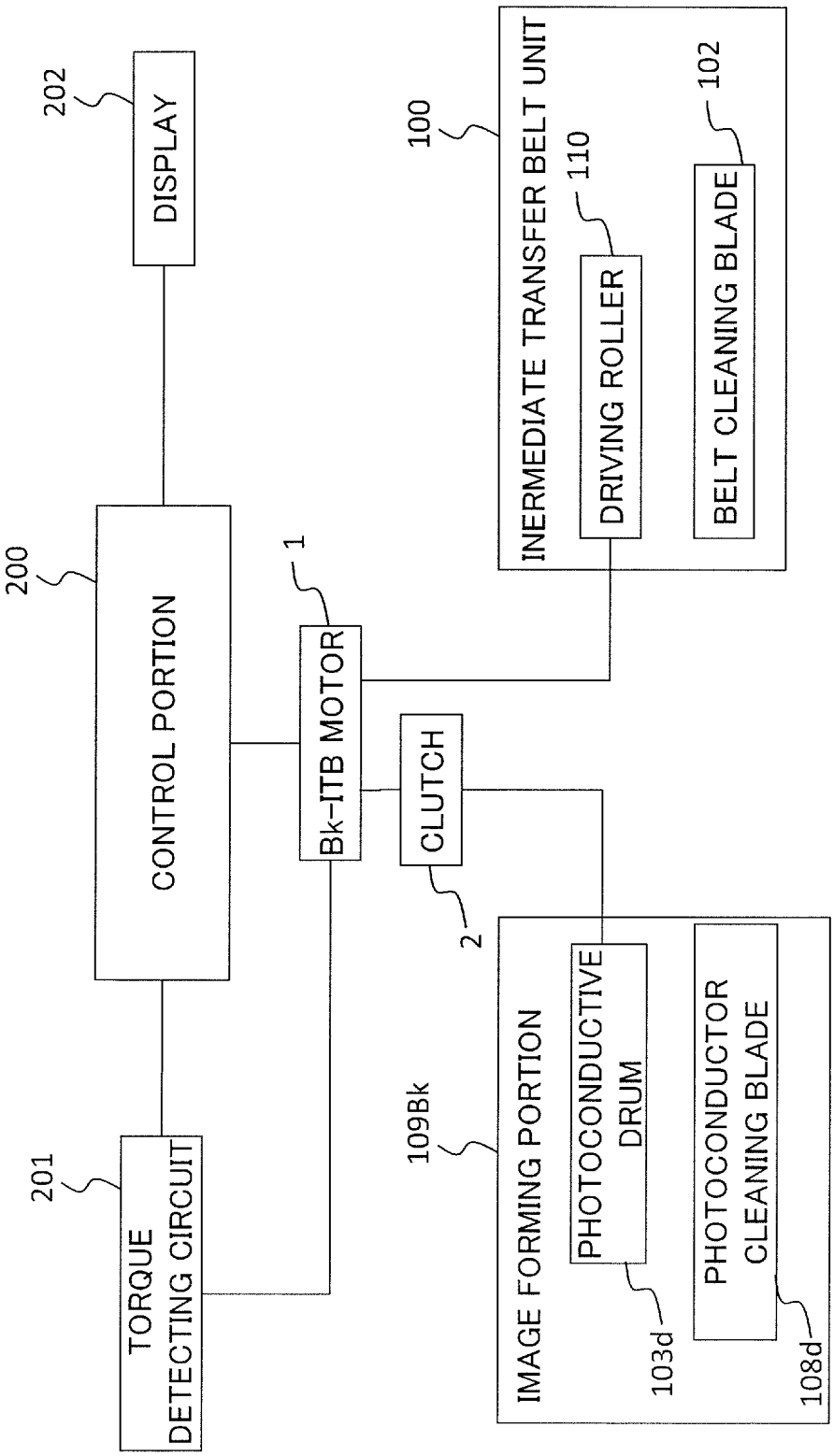
202
DISPLAY
100
INERMEDIATE TRANSFER BELT UNIT
110
DRIVING ROLLER
102
BELT CLEANING BLADE
200
CONTROL PORTION
1
Bk-ITB MOTOR
CLUTCH
2
109Bk
IMAGE FORMING PORTION
PHOTOCONDUCTIVE DRUM
103d
PHOTOCONDUCTOR CLEANING BLADE
108d
201
TORQUE DETECTING CIRCUIT

FIG.9

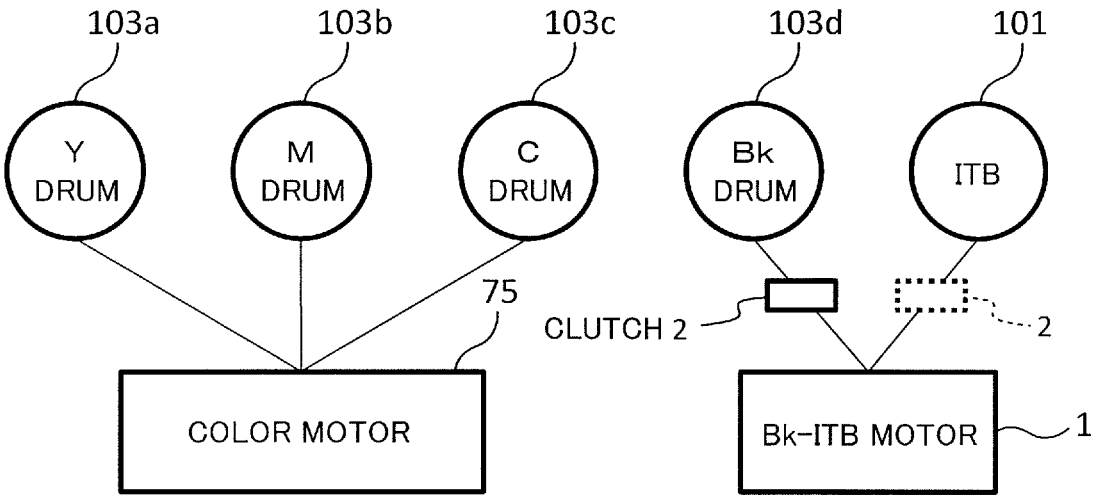
103a
103b
103c
103d
101
Y DRUM
M DRUM
C DRUM
Bk DRUM
ITB
75
CLUTCH 2
2
COLOR MOTOR
Bk-ITB MOTOR
1

FIG.10

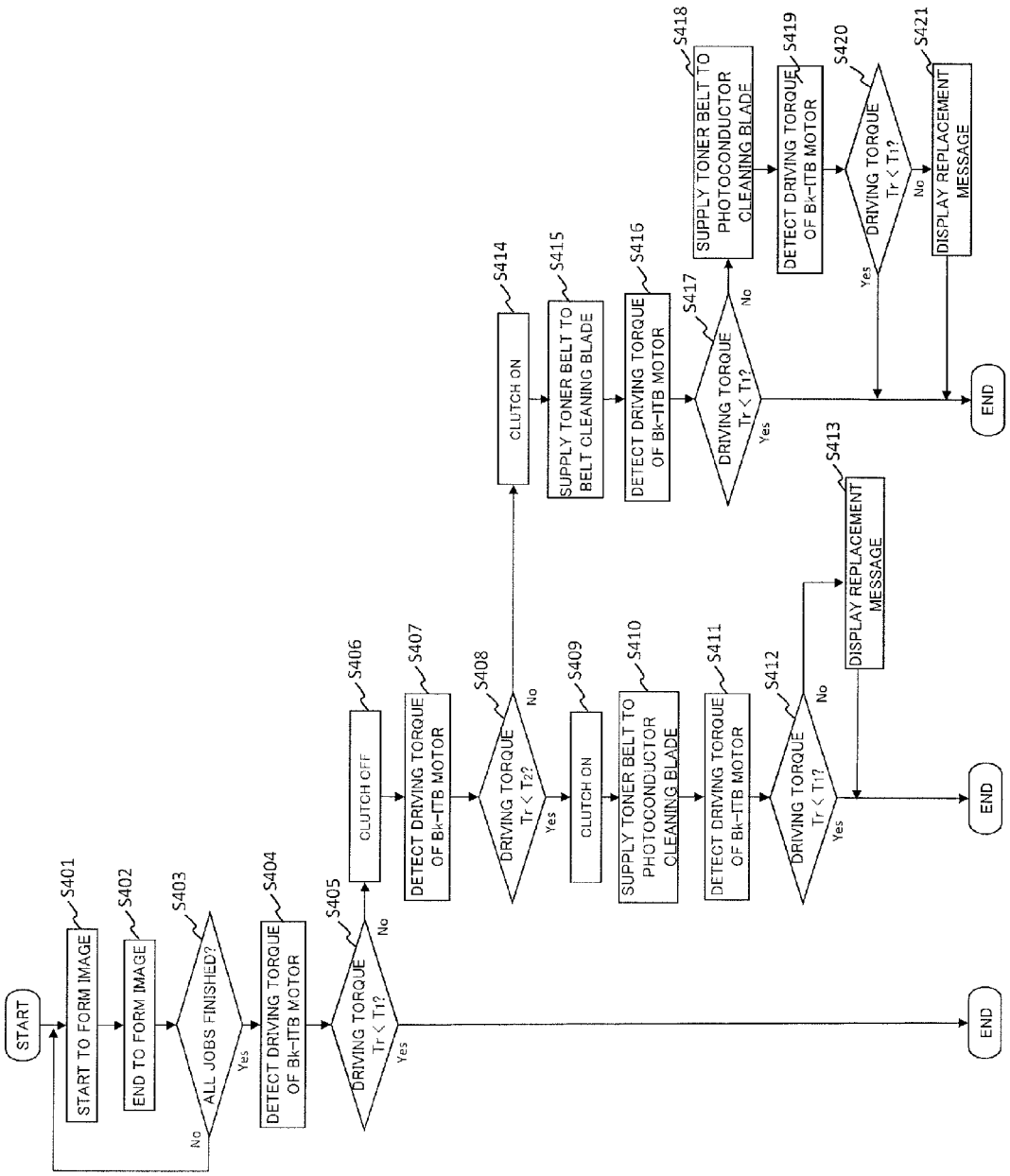
START
START TO FORM IMAGE
S401
END TO FORM IMAGE
S402
ALL JOBS FINISHED?
S403
No
Yes
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S404
DRIVING TORQUE Tr < T1?
S405
Yes
No
CLUTCH OFF
S406
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S407
DRIVING TORQUE Tr < T2?
S408
Yes
No
CLUTCH ON
S409
SUPPLY TONER BELT TO PHOTOCONDUCTOR CLEANING BLADE
S410
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S411
DRIVING TORQUE Tr < T1?
S412
Yes
No
DISPLAY REPLACEMENT MESSAGE
S413
END
CLUTCH ON
S414
SUPPLY TONER BELT TO BELT CLEANING BLADE
S415
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S416
DRIVING TORQUE Tr < T1?
S417
Yes
No
SUPPLY TONER BELT TO PHOTOCONDUCTOR CLEANING BLADE
S418
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S419
DRIVING TORQUE Tr < T1?
S420
Yes
No
DISPLAY REPLACEMENT MESSAGE
S421
END
END

FIG.11

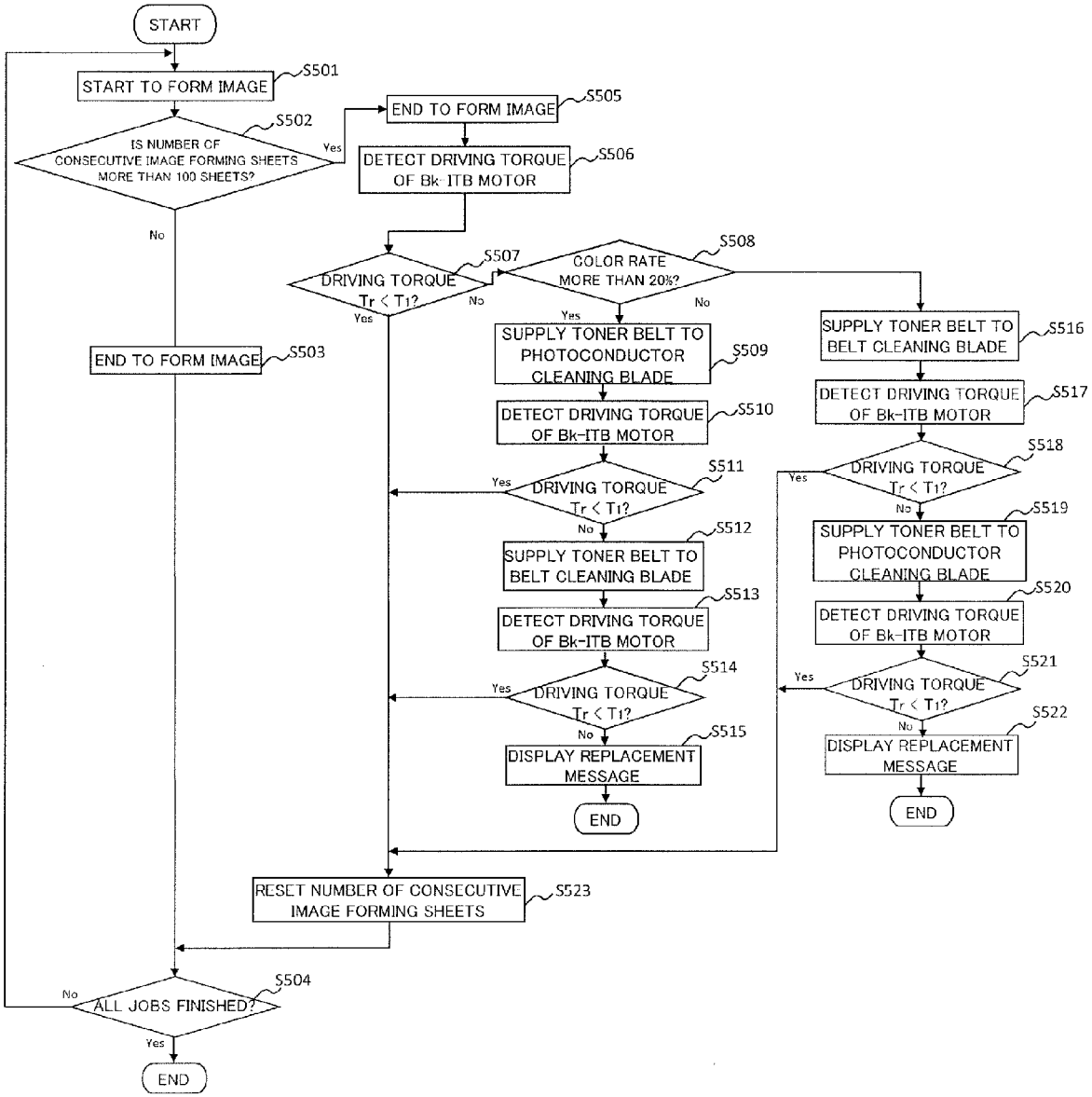
START
START TO FORM IMAGE
S501
S502
IS NUMBER OF CONSECUTIVE IMAGE FORMING SHEETS MORE THAN 100 SHEETS?
Yes
No
END TO FORM IMAGE
S503
END TO FORM IMAGE
S505
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S506
DRIVING TORQUE Tr < T1?
S507
Yes
No
COLOR RATE MORE THAN 20%?
S508
Yes
No
SUPPLY TONER BELT TO PHOTOCONDUCTOR CLEANING BLADE
S509
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S510
DRIVING TORQUE Tr < T1?
S511
Yes
No
SUPPLY TONER BELT TO BELT CLEANING BLADE
S512
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S513
DRIVING TORQUE Tr < T1?
S514
Yes
No
DISPLAY REPLACEMENT MESSAGE
S515
END
SUPPLY TONER BELT TO BELT CLEANING BLADE
S516
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S517
DRIVING TORQUE Tr < T1?
S518
Yes
No
SUPPLY TONER BELT TO PHOTOCONDUCTOR CLEANING BLADE
S519
DETECT DRIVING TORQUE OF Bk-ITB MOTOR
S520
DRIVING TORQUE Tr < T1?
S521
Yes
No
DISPLAY REPLACEMENT MESSAGE
S522
END
RESET NUMBER OF CONSECUTIVE IMAGE FORMING SHEETS
S523
ALL JOBS FINISHED?
S504
No
Yes
END

IMAGE FORMING APPARATUS WITH LUBRICANT SUPPLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image forming apparatus such as a printer and a copier.

2. Description of the Related Art

Hitherto, there have been known various image forming apparatuses adopting electro-photographic or electrostatic recording system in their image forming process, and as one example of these various image forming apparatuses, there is a tandem type image forming apparatus in which a plurality of process cartridges is arrayed in a row along a rotational direction of an intermediate transfer belt rotatably stretched and which is configured to form a color image through the intermediate transfer belt.

This type of full-color image forming apparatus includes a photoconductor cleaning blade removing residual toner left on the photoconductive drum (image carrier) after a primary transfer and a second cleaning blade removing residual toner left on the intermediate transfer belt after a secondary transfer.

As such a cleaning blade, a counter-type cleaning blade made of an elastic material such as rubber is brought into contact so as to face in a driving direction is adopted in general. This counter-type blade cleaning is known to cause a problem called turn-up of the blade in a case where friction forces between the cleaning blade and the photoconductive drum and between the cleaning blade and the intermediate transfer belt increase.

Then, conventionally, Japanese Patent Application Laid-open Nos. 2004-258419 and 2005-106920 disclose to avoid the occurrence of the turn-up of the blade or the like by supplying lubricant to nip portions between the cleaning blade and the photoconductive drum and the cleaning blade and the intermediate transfer belt to reduce the friction forces.

Specifically, Japanese Patent Application Laid-open No. 2004-258419 discloses to detect a driving torque of a photoconductive drum by a current detecting portion, and based on the detection result, to determine an abnormality of the cleaning blade of a cleaning unit, and to supply lubricant toner to avoid the abnormality.

Japanese Patent Application Laid-open No. 2005-106920 discloses to change a length in a sub-scan direction of a toner belt in a case where a print set number is less than a first reference value. That is, JPA No. 2005-106920 discloses to change the length in the sub-scan direction of the toner belt corresponding to a total number of pixels drawn into a predetermined length of an area from both ends of the cleaning blade during preparation of a most recent total number within a second reference value of prints and to an intra-apparatus temperature just before forming the toner belt.

By the way, while both JPA Nos. 2004-258419 and 2005-106920 describe the image forming apparatuses configured to prevent turn-up of the blade from occurring by supplying lubricant toner for the cleaning blade cleaning the photoconductive drum, there is a case where such cleaning blade is provided for the intermediate transfer belt as described in JPA No. 2005-106920.

In such a case, if a friction between the cleaning blade and the intermediate transfer belt increases, there is a possibility that the turn-up of the cleaning blade cleaning the intermediate transfer belt occurs as well. However, no consideration is made concerning the possibility of causing the turn-up of the cleaning blade for the intermediate transfer belt in the image forming apparatuses described in JPA Nos. 2004-258419 and 2005-106920.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention, an image forming apparatus includes first and second rotatably supported image carriers, an intermediate transfer belt rotatably conveying a toner image transferred thereto, a driving source rotationally driving both the intermediate transfer belt and the second image carrier, a first cleaning blade rubbing the intermediate transfer belt at a first rubbing position, a second cleaning blade rubbing the second image carrier at a second rubbing position, a lubricant supplying portion configured to be able to supply lubricant to the first or second rubbing position, a load detecting portion configured to detect a driving load of the driving source, and a control portion configured to be able to execute a lubricant supplying mode of supplying lubricant to either one of the first and second rubbing positions on a basis of processing contents of a most recent predetermined number of times of image forming operations in a case where the driving load detected by the load detecting portion exceeds a predetermined value.

According to a second aspect of the present invention, an image forming apparatus includes first and second rotatably supported image carriers, an intermediate transfer belt rotatably conveying a toner image transferred thereto, a driving source rotationally driving both the intermediate transfer belt and the second image carrier, a clutch portion connecting/disconnecting the transmission of the drive from the driving source to either one of the intermediate transfer belt and the second image carrier, a first cleaning blade rubbing the intermediate transfer belt at a first rubbing position, a second cleaning blade rubbing the second image carrier at a second rubbing position, a lubricant supplying portion configured to be able to supply lubricant to the first or second rubbing position, a load detecting portion configured to detect a driving load of the driving source, and a control portion configured to be able to execute a lubricant supplying mode in a case where the driving load detected by the load detecting portion exceeds a first predetermined value and supplying the lubricant to either one of the first and second rubbing positions on a basis of a result obtained by detecting the driving load of the driving source again by the load detecting portion in a state in which either one of the intermediate transfer belt and the second image carrier is disconnected from the driving source by the clutch portion.

Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic section view illustrating a schematic configuration of an image forming apparatus according embodiments of the present invention.

FIG. **2** is a block diagram of a control system executing a toner belt supplying operation of a first embodiment of the present invention.

FIG. **3**A is a diagram illustrating a configuration in driving photoconductive drums and an intermediate transfer belt of the first embodiment.

FIG. **3**B is a diagram schematically illustrating a configuration in a case where the photoconductive drums and the intermediate transfer belt are driven by different motors.

FIG. **4**A is a graph illustrating a driving torque of a Bk-ITB motor in a case where lubricant steadily exists.

FIG. **4**B is a graph illustrating the driving torque of the Bk-ITB motor in a case where turn-up of a blade occurs.

FIG. **4**C is a graph illustrating the driving torque of the Bk-ITB motor in a case where a toner belt is supplied to a rubbing portion when the driving torque exceeds a threshold value.

FIG. **5** is a flowchart of processes in supplying the toner belt according to the first embodiment of the present invention.

FIG. **6** is a flowchart of processes in supplying the toner belt according to a second embodiment of the present invention.

FIG. **7** is a flowchart of processes in supplying the toner belt according to a third embodiment of the present invention.

FIG. **8** is a block diagram of a control system executing a toner belt supplying operation of a fourth embodiment of the present invention.

FIG. **9** is a diagram illustrating a configuration in driving the photoconductive drums and the intermediate transfer belt in the fourth embodiment.

FIG. **10** is a flowchart of processes in supplying the toner belt according to a fourth embodiment of the present invention.

FIG. **11** is a flowchart of processes in supplying the toner belt according to a fifth embodiment of the present invention.

DESCRIPTION OF THE EMBODIMENTS

First Embodiment

An embodiment of the present invention will be described in detail with reference to the drawings. A same reference numeral denotes a same or corresponding part throughout several views. It is noted that while a main part concerning formation and transfer of a toner image will be explained in the present embodiment, the present invention is applicable also to various uses such as various printers, copiers, facsimiles and multi-function printers by adding required devises, units and a case structure.

[Image Forming Apparatus]

An image forming apparatus **70** of the present embodiment will be described with reference to FIG. **1**. FIG. **1** is a schematic section view illustrating a schematic structure of the image forming apparatus **70** such as a tandem-type intermediate transfer type full-color printer of the present embodiment.

As shown in FIG. **1**, the image forming apparatus **70** has an apparatus body **70***a*, and an intermediate transfer belt unit **100** having an intermediate transfer belt (ITB) **101** is disposed at a vertically middle stage position within the apparatus body **70***a*. The intermediate transfer belt unit **100** includes image forming portions **109**Y, **109**M, **109**C and **109**Bk arrayed in order from upstream in a conveying direction along a lower conveying face of the intermediate transfer belt **101**. These image forming portions **109**Y through **109**Bk form toner images of respective colors of yellow (Y), magenta (M), cyan (C) and black (Bk) to the intermediate transfer belt **101** that is driven and conveyed.

The image forming portions **109**Y through **109** respectively include a drum-shaped electro-photographic body (referred to as a "photoconductive drum" hereinafter) **103***a* through **103***d* as latent image carriers. The photoconductive drums **103***a* through **103***d* are configured to be driven and to rotate in a direction of an arrow (clockwise) shown in FIG. **1**. It is noted that the photoconductive drums **103***a*, **103***b*, and **103***c* compose a first image carrier rotatably supported and the photoconductive drum **103***d* composes a second image carrier rotatably supported.

The intermediate transfer belt unit **100** includes a driving roller **110** that functions also as a secondary transfer inner roller, stretching rollers **113** and **114**, and a tension roller **115**, which are disposed respectively in a predetermined positional relationship. The endless intermediate transfer belt **101** is stretched (supported) so as to be able to rotate in a circumferential direction (in a direction of an arrow R) by these rollers **110**, **113**, **114**, and **115**, and rotates and conveys the toner image transferred thereto. A tension force toward an outside is applied to the intermediate transfer belt **101** by the tension roller **115**.

Primary transfer rollers **107***a*, **107***b*, **107***c*, and **107***d* are disposed between the stretch rollers **113** and **114** on an inner circumferential side of the intermediate transfer belt **101**. A transfer bias is applied to each of these primary transfer rollers **107***a* through **107***d* respectively by a bias applying portion not shown. The photoconductive drums **103***a* through **103***d* are disposed at positions respectively facing to the primary transfer rollers **107***a* through **107***d* while interposing the intermediate transfer belt **101** therebetween. The primary transfer rollers **107***a* through **107***d* press a back side (inner face side) of the intermediate transfer belt **101** and a surface thereof is in contact with the photoconductive drums **103***a* through **103***d* respectively in the image forming portions **109**Y through **109**Bk.

Primary transfer nip portions Ta, Tb, Tc, and Td are formed between the photoconductive drums **103***a* through **103***d* and the intermediate transfer belt **101** respectively as primary transfer portions. The intermediate transfer belt **101** is rotated counterclockwise by the counterclockwise rotation of the driving roller **110** that also functions as the secondary transfer inner roller. Rotational speed of the intermediate transfer belt **101** is set to be substantially equal to rotational speed (process speed) of the respective photoconductive drums **103***a* through **103***d*. The photoconductive drums **103***a* through **103***c*, the first image carrier, the primary transfer portions Ta through Tc will be referred also as a first primary transfer portion. The photoconductive drum **103***d*, the second image carrier and the primary transfer portion Td will be also referred to as a second primary transfer portion.

Disposed around each of the photoconductive drums **103***a* through **103***d* are, in order along a rotational direction thereof, primary charging roller **104***b*, **104***b*, **104***c*, **104***d*, and exposure units **105***a*, **105***b*, **105***c*, and **105***d*. Disposed also around the photoconductive drums **103***a* through **103***d* are developing units **106***a*, **106***b*, **106***c*, and **106***d*, and photoconductor cleaning blades **108***a*, **108***b*, **108***c*, and **108***d*. The developing units **106***a* through **106***d* have developing sleeves Sa, Sb, Sc and Sd, respectively.

Rubbing portions ra, rb, rc and rd of edges of the respective blades rubbing the surfaces of the photoconductive drums **103***a* through **103***d* to scrape the transfer residual toner and others on the drums are formed respectively between the photoconductor cleaning blades **108***a* through **108***d* and the corresponding photoconductive drums **103***a* through **103***d*. It is noted that the photoconductor cleaning blade **108***d* composes a second cleaning blade rubbing the photoconductive drum **103***d* by the rubbing portion rd (second rubbing position) so as to remove the toner on the photoconductive drum **103***d* (second image carrier).

Image signals of yellow, magenta, cyan, and black are inputted respectively to exposure units **105***a* through **105***d*, and corresponding to the image signals, the exposure units **105***a* through **105***d* irradiates laser beams to the respective

surfaces of the photoconductive drums **103***a* through **103***d* to neutralize the charges and to form electrostatic latent images.

A secondary transfer outer roller **111** is disposed at a position facing the driving roller **110** on the surface of the intermediate transfer belt **101**. The secondary transfer outer roller **111** nips the intermediate transfer belt **101** between the secondary transfer outer roller **111** and the driving roller **110**, and Ts, i.e., a secondary transfer portion, is formed between the secondary transfer outer roller **111** and the intermediate transfer belt **101**.

The secondary transfer portion Ts secondarily transfers the toner image formed on the intermediate transfer belt **101** to a recording medium (sheet) P sent from a feeding portion not shown. A positive polarity bias is applied to the secondary transfer outer roller **111** of the secondary transfer portion Ts. The four color toner images on the intermediate transfer belt **101** are secondarily transferred to the recording medium P conveyed thereto by a registration roller not shown by the positive polarity bias applied to the secondary transfer portion Ts through the secondary transfer outer roller **111**.

Still further, a belt cleaning blade **102** of a belt cleaning unit **71** is disposed at a position facing to the tension roller **115** such that it is in contact with the surface of the intermediate transfer belt **101**. A rubbing portion rB of the belt cleaning blade **102** scraping transfer residual toner and others on the intermediate transfer belt **101** by rubbing an edge of the belt cleaning blade **102** is formed between the belt cleaning blade **102** and the intermediate transfer belt **101** on the tension roller **115**. It is noted that the belt cleaning blade **102** composes a first cleaning blade rubbing the intermediate transfer belt **101** at the rubbing portion rB (first rubbing position) to remove the toner on the intermediate transfer belt **101**.

A fixing unit **112** including a fixing roller **112***a* and a pressure roller **112***b* is disposed downstream in the recording medium conveying direction of the secondary transfer portion Ts. A discharge roller pair **72** and a discharge tray **73** are disposed further downstream of the fixing unit **112**.

The recording medium P on which the toner images have been secondarily transferred at the secondary transfer portion Ts is conveyed to a fixing nip portion between the fixing roller **112***a* and the pressure roller **112***b* to be heated and pressed by the fixing roller **112***a* and the pressure roller **112***b* such that the toner images are melted and fixed on the surface of the recording medium P.

The feeding portion not shown including a sheet feed cassette not shown in which recording media to be supplied to form images are stacked is disposed at an under part of the apparatus body **70***a*. The recording media are fed sequentially by a sheet feed roller and others not shown to be conveyed to the registration roller pair.

The apparatus body **70***a* includes a control portion **200** including a ROM, a RAM and a memory. A Bk-ITB motor **1**, a torque detecting circuit **201** and a color motor **75** are connected to the control portion **200**.

[Operation of Image Forming Apparatus]

In the image forming apparatus **70** constructed as described above, a yellow toner image is formed on the photoconductive drum and is transferred to the intermediate transfer belt **101** in an image forming portion **109**Y. A magenta toner image is formed in the same manner with the image forming portion **109**Y on the photoconductive drum and is transferred and superimposed on the yellow toner image on the intermediate transfer belt **101** in an image forming portion **109**M. Cyan and black toner images are formed in the image forming portions **109**C and **109**Bk in the same manner with the image forming portion **109**Y and are sequentially transferred and superimposed on the intermediate transfer belt **101**.

The four color toner images carried on the intermediate transfer belt **101** are conveyed to the secondary transfer portion Ts to be secondarily transferred collectively to the recording medium P. The recording medium P on which the four color toner images have been secondarily transferred is curvature-separated from the intermediate transfer belt **101** and is sent to the fixing unit **112**. The fixing unit **112** heats and presses the recording medium P by the fixing roller **112***a* and the pressure roller **112***b* to melt the toner to fix the image on the surface of the recording medium P. After that, the recording medium P is discharged to the discharge tray **73** through the discharge roller pair **72**.

[Detail of Image Forming Portion]

The image forming portions **109**Y through **109**Bk are constructed substantially in the same manner except that the colors of the toners used in the developing units **106***a* through **106***d* are different as yellow, magenta, cyan, and black. Then, a toner image forming process of the image forming portion **109**Bk of black will be described in the following explanation and an overlapped description concerning other image forming portions **109**Y, **109**M, and **109**C will be omitted here.

That is, the photoconductive drum **103***d* in the image forming portion **109**Bk forms a photoconductive layer whose charge polarity is negative on the surface thereof and rotates in the direction of the arrow with predetermined processing speed.

The charge roller **104***d* negatively charges the surface of the photoconductive drum **103***d* by applying a vibration voltage as an AC voltage superimposed with a negative polarity DC voltage. The exposure unit **105***d* draws an electrostatic image on the surface of the photoconductive drum **103***d* by scanning a laser beam obtained by ON-OFF modulating scan line image data obtained by developing a color separated image of black by a polygonal mirror.

The developing unit **106***d* frictionally electrifies two-component developer containing non-magnetic toner whose charging polarity is negative and magnetic carrier and conveys the toner to a part facing the photoconductive drum **103***d* by carrying by the development sleeve Sd. The toner negatively charged is transferred to an exposed part of the photoconductive drum **103***d* which has become relatively positive by the vibration voltage in which the AC voltage superimposed with the negative DC voltage is applied to the development sleeve Sd and thus, the electrostatic image is reversely developed.

The primary transfer roller **107***d* forms the primary transfer portion Td between the photoconductive drum **103***d* and the intermediate transfer belt **101**. The toner image carried on the photoconductive drum **103***d* is primarily transferred to the intermediate transfer belt **101** by applying a positive polarity DC voltage to the primary transfer roller **107***d*. The photoconductor cleaning blade **108***d* is in contact with the photoconductive drum **103***d* and recovers the transfer residual toner left on the photoconductive drum **103***d*.

The secondary transfer outer roller **111** is in contact with an outer surface of the intermediate transfer belt **101** between the image forming portion **109**Bk to the belt cleaning blade **102** in the toner image conveying direction. The secondary transfer outer roller **111** composes the secondary transfer portion Ts by being in contact with the outer surface of the intermediate transfer belt **101** whose inner surface is supported by the driving roller **110** that functions also as the secondary transfer inner roller.

The full-color toner image carried on the intermediate transfer belt **101** is secondarily transferred to the recording medium P by applying a positive polarity DC voltage to the secondary transfer outer roller **111**. The belt cleaning blade **102** is in contact with the intermediate transfer belt **101** while facing to the tension roller **115** to recover the transfer residual toner left on the intermediate transfer belt **101**.

The intermediate transfer belt **101** is an endless belt driven and conveyed in the direction of the arrow R as described above, and is stretched around the driving roller **110**, the stretch rollers **113** and **114** and the tension roller **115** that applies a predetermined tension to the intermediate transfer belt **101**. It is noted that a number of rollers stretching the intermediate transfer belt **101** is not limited to the configuration shown in FIG. **1**.

[Detail of Cleaning Blade]

Urethane rubber having a JIS-A hardness of rubber hardness of 73° is used as a material of the photoconductor cleaning blades **108***a* through **108***d* in the present embodiment. The photoconductor cleaning blades **108***a* through **108***d* are configured such they are in contact so as to face in the rotational direction of the respective photoconductive drums **103***a* through **103***d* with a set angle of 25° and a contact pressure of 35 N/m. However, the present invention is not limited to such configuration.

A material of the belt cleaning blade **102** is urethane rubber having a JIS-A hardness of rubber hardness of 77°. The belt cleaning blade **102** is configured such that it is in contact so as to face in the rotational direction of the tension roller **115** (the intermediate transfer belt **101**) with a set angle of 25° and a contact pressure of 30 N/m. However, the present invention is not limited to such configuration.

[Driving Configuration of Image Forming Apparatus]

In order to cut a cost of the image forming apparatus **70**, the image forming apparatus **70** is configured such that the photoconductive drums **103***a* (Y drum), **103***b* (M drum), and **103***c* (C drum) are rotationally driven by the common color motor **75** as shown in FIGS. **1** and **3**A in the present embodiment. The photoconductive drum **103***d* (Bk drum) and the intermediate transfer belt **101** (the driving roller **110**) are also commonly rotationally driven by the Bk-ITB motor **1**. It is noted that the Bk-ITB motor **1** composes a driving source commonly and rotationally driving the intermediate transfer belt **101** and the photoconductive drum **103***d* (second image carrier).

As shown in FIG. **3**B, this configuration makes it possible to reduce a number of motors from five to two as compared to the configuration in which the photoconductive drums **103***a* through **103***d* and the intermediate transfer belt **101** (the driving roller **110**) are driven by the other motors. The other motors are a Y motor **74***a*, a M motor **74***b*, C a motor **74***c*, and a Bk motor **74***d*, and an ITB motor **76**. Thus, the considerable cut of the cost of the image forming apparatus **70** is realized by the present embodiment.

[Driving Torque of Bk-ITB Motor]

The present embodiment includes the torque detecting circuit **201** detecting a driving torque (driving load) of the Bk-ITB motor **1**, i.e., the driving source. It is noted that although the configuration of the torque detecting circuit **201** is not specifically limited, the torque detecting circuit **201** of the present embodiment adopts a method of detecting a driving current of the Bk-ITB motor **1** and converting its detected value into the driving torque by utilizing that the motor driving torque and the current value are proportional.

As described above, if the friction forces between the cleaning blade and the photoconductive drum and between the cleaning blade and the intermediate transfer belt increase, such problems that chipping and turn-up of the cleaning blade occur. It is possible to prevent such problem by supplying lubricant to rubbing portions (nip portions) between the cleaning blade and the photoconductive drum and between the cleaning blade and the intermediate transfer belt. A toner belt is supplied as the lubricant in the present embodiment. This 'toner belt' is what is formed as a belt-like toner image formed in a width direction of the intermediate transfer belt **101** by either one of the image forming portions **109**Y through **109**Bk (the image forming portion **109**Bk in the present embodiment).

In the present embodiment, the friction forces between the cleaning blade and the photoconductive drum and between the cleaning blade and the intermediate transfer belt are detected as driving torques of the motor and the toner belt is supplied as lubricant in a case where the driving torque exceeds a predetermined threshold value.

The driving torque Tr of the Bk-ITB motor **1** fluctuates largely in scraping the transfer residual toner by the photoconductor cleaning blade **108***d* and the belt cleaning blade **102**, so that it is desirable to detect the driving torque Tr during a pre-rotation time before forming an image or during a post-rotation time after forming an image. It is also possible to provide a torque detecting mode for detecting the driving torque Tr of the Bk-ITB motor **1** by interrupting an image forming operation.

[Correlation Between Driving Torque and Number of Times of Image Forming Operations]

Here, a correlation between the driving torque Tr and a number of times of image forming operations (number of image formed recording media during an endurance test) will be explained. It is noted that FIGS. **4**A through **4**C are graphs illustrating the driving torque Tr of the Bk-ITB motor **1**.

As shown in FIG. **4**A, in a case where the lubricant stationary exists at the rubbing portion rB between the belt cleaning blade **102** and the intermediate transfer belt **101** and at the rubbing portion rd between the photoconductor cleaning blade **108***d* and the photoconductive drum **103***d*, the driving torque Tr turns out as follows. That is, in the case where toner or external additive, i.e., the lubricant, stationarily exists at the rubbing portions rB and rd, the driving torque Tr of the Bk-ITB motor **1** moderately increases corresponding to the number of times of image forming operations and saturates substantially to a certain value T0 (saturation value T0 lower than a threshold value T1).

However, if the image forming operations of forming images consuming less toner such as solid white images are repeated, the driving torque Tr of the Bk-ITB motor **1** increases sharply as shown in FIG. **4**B. This ends up causing turn-up of the belt cleaning blade **102** and the photoconductor cleaning blade **108***d*.

When the driving torque Tr exceeds the threshold value T_1 as shown in FIG. **4**C, the toner belt is supplied to the rubbing portion rB between the belt cleaning blade **102** and the intermediate transfer belt **101** and to the rubbing portion rd between the photoconductor cleaning blade **108***d* and the photoconductive drum **103***d*. Thereby, the driving torque Tr of the Bk-ITB motor **1** decreases below the saturation value T_0 and is stabilized at the saturation value T_0 after that.

The inventors et al. found that the saturation value T_0 of the driving torque Tr of the Bk-ITB motor **1** is around 0.04 to 0.045 kgf·m (0.392 to 0.441 N/m). The inventors et al. also found that the turn-up of the belt cleaning blade **102** and the photoconductor cleaning blade **108***d* tend to frequently occur when the driving torque Tr of the Bk-ITB motor **1** increases more than 0.06 kgf·m (0.588 N/m).

Then, the threshold value T_1 of the driving torque Tr of the Bk-ITB motor **1** will be set at 0.05 kgf·m (0.490 N/m) by considering also chipping of the belt cleaning blade **102** and the photoconductor cleaning blade **108***d* in the present embodiment. However, the present invention is not limited to these specific numerical values.

[Lubricant Supplying Portion]

The toner belt is supplied as the lubricant to the rubbing portion rB between the intermediate transfer belt **101** and the belt cleaning blade **102** and to the rubbing portion rd between the photoconductive drum **103***d* and the photoconductor cleaning blade **108***d* in the present embodiment. It is noted that the image forming portion **109**Bk or more specifically the developing unit **106***d* of the image forming portion **109**Bk of the present embodiment composes a lubricant supplying portion capable of supplying the lubricant to the rubbing portion rB, i.e., a first rubbing position, or to the rubbing portion rd, i.e., a second rubbing position.

A case of forming the toner belt as the lubricant in the image forming portion **109**Bk will be exemplified and explained. It is noted that it is also possible to provide a different lubricant supplying portion and to use powder lubricant and liquid lubricant other than the toner. Still further, the lubricant supplying portion may be configured so as to include not only the image forming portion **109**Bk, but also at least one of the developing units **106***a* through **106***c* of the other image forming portions **109**Y, **109**M and **109**C.

The toner belt used as the lubricant is formed in an entire range of a developing width of the developing unit **106***d*. In a case when the toner belt is supplied to the rubbing portion rd, a DC voltage of inverse polarity from that in forming an image is applied to the primary transfer roller **107***d*. It is possible to supply the toner belt thus formed effectively to the rubbing portion rd by reducing an amount to be primarily transferred to the intermediate transfer belt **101**. It is noted that a DC voltage of an inverse polarity from that in forming an image is applied also to the secondary transfer outer roller **111** to prevent the secondary transfer outer roller **111** from being contaminated by the toner.

Meanwhile, in a case where the toner belt is supplied to the rubbing portion rB between the belt cleaning blade **102** and the intermediate transfer belt **101**, a DC voltage of the same polarity with that in forming an image is applied to the primary transfer roller **107***d* and a DC voltage of an inverse polarity from that in forming an image is applied to the secondary transfer outer roller **111**. This arrangement makes it possible to supply the toner belt thus formed to the rubbing portion rB effectively bypassing, without adhering, the secondary transfer outer roller **111** and to prevent the secondary transfer outer roller **111** from being contaminated by the toner.

As described above, in a case of supplying the lubricant to the rubbing portion rB (first rubbing position), the control portion **200** applies the primary transfer bias having the same polarity with that in normally forming an image to the primary transfer roller **107***d* in the present embodiment. In the same time, the control portion **200** controls such that the secondary transfer bias having the inverse polarity from that in normally forming an image is applied to the secondary transfer outer roller **111**. Still further, in a case of supplying the lubricant to the rubbing portion rd (second rubbing position), the control portion **200** controls such that the primary transfer bias and the secondary transfer bias having the inverse polarity from that in normally forming an image are applied respectively to the primary transfer roller **107***d* and the secondary transfer outer roller **111**. These controls are made in the same manner also in second through fifth embodiments described later.

It is noted that while a color of the toner belt supplied to the rubbing portion rB may be any color of yellow, magenta, cyan and black, a black toner belt formed in the image forming portion **109**Bk will be supplied in the present embodiment.

A toner loading amount of the toner belt is 0.5 mg/cm^2 and a length in the conveying direction of the toner belt is 10 mm in the present embodiment. Set values of the DC voltages applied to the primary transfer roller **107***d* and the secondary transfer outer roller **111** in forming an image are 900 V and 1500 V, respectively.

Set values of the DC voltages of the inverse polarity from that in forming an image and applied to the primary transfer roller **107***d* and the secondary transfer outer roller **111** in supplying the toner belt are −500 V and −300 V, respectively, in the present embodiment. However, the present invention is not limited to these specific numerical values.

Next, a configuration for giving priority to the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** in the present embodiment will be explained in detail.

That is, it is difficult to individually measure the driving torque of the photoconductive drum and the driving torque of the intermediate transfer belt in the configuration in which the photoconductive drum **103**Bk and the intermediate transfer belt **101** are commonly driven by the Bk-ITB motor **1** in the present embodiment, so that it is difficult to accurately determine which one of the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** requires the supply of the toner belt from the driving torque of the Bk-ITB motor **1**. That is, it is unable to determine which one of the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** requires the supply of the toner belt in the case where the driving torque Tr of the Bk-ITB motor **1** exceeds the threshold value T_1 set in advance. Still further, if the lubricant (toner) is supplied to both of the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** always when the driving torque Tr of the Bk-ITB motor **1** exceeds the threshold value T_1 set in advance, the lubricant is supplied also to the cleaning blade which originally requires no lubricant. Thus, the lubricant is consumed wastefully and a life of the image forming portion **109**Bk (the developing unit **106***d*) is shortened.

Accordingly, in order to suppress the unnecessary toner consumption and to supply the lubricant efficiently, it is necessary to give the priority to the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** by setting criteria other than the driving torque Tr of the Bk-ITB motor **1**.

In the present embodiment, a rate of full-color images in a most recent predetermined number of times of image forming operations performed in the image forming apparatus **70** (referred to as a 'full-color rate1' (a rate of execution of a full-color mode) hereinafter) will be adopted as the criteria in the present embodiment.

As described above, the photoconductor cleaning blade **108***d* scrapes the transfer residual toner left on the photoconductive drum **103***d* without being transferred to the intermediate transfer belt **101** in the first transfer portion (second primary transfer portion) Td.

The belt cleaning blade **102** also scrapes the transfer residual toner left on the intermediate transfer belt **101** without being secondarily transferred to the recording medium P in the secondary transfer portion Ts. The belt cleaning blade **102** scrapes the four colors of transfer residual toners from the image forming portions **109**Y, **109**M, **109**C, and **109**Bk in forming a full-color image and scrapes the transfer residual

toner of one color from the image forming portion **109**Bk in forming a white and black image.

Accordingly, the toner tends to be depleted more at the rubbing portion rd between the photoconductor cleaning blade **108***d* and the photoconductive drum **103***d* than the rubbing portion rB between the belt cleaning blade **102** and the intermediate transfer belt **101** in forming a full-color image. Therefore, in a case where the most recent color rate (rate of execution of the full-color mode) is high, the toner belt is supplied in priority to the rubbing portion rd. Meanwhile, in a case where the most recent color rate is low, the toner belt is supplied in priority to the rubbing portion rB in the present embodiment even though it is possible to give the priority to either one of the rubbing portions rd and rB.

The priority level of the supply of the toner belt to the rubbing portions rd and rB is determined based on the color rate of a most recent 100 images when the driving torque Tr of the Bk-ITB motor **1** exceeds the threshold value T_1 in the present embodiment. For instance, in a case where the color rate is 20% or more, the priority is given to the rubbing portion rd of the photoconductor cleaning blade **108***d* and in a case where the color rate is less than 20%, the priority is given to the rubbing portion rB of the belt cleaning blade **102**. However, the present invention is not limited to these specific numerical values.

Next, a control system of the present embodiment will be explained. It is noted that FIG. **2** is a block diagram of the control system executing the supply of the toner belt in the present embodiment, and FIG. **5** is a flowchart concerning processes in supplying the toner belt in the present embodiment.

As shown in FIG. **2**, the torque detecting circuit **201**, the Bk-ITB motor **1** and a display **202** provided within the apparatus body **70***a* are connected to the control portion **200** including the memory portion **210** (see FIG. **1**) composed of the ROM, RAM and others. The display **202** is provided visibly in the apparatus body **70***a* of the image forming apparatus **70**. The image forming portion **109**Bk also includes the photoconductive drum **103***d* and the photoconductor cleaning blade **108***d*. The intermediate transfer belt unit **100** includes the intermediate transfer belt **101**, the driving roller **110** and the belt cleaning blade **102**.

It is noted that the control portion **200** of the present embodiment executes the abovementioned control based on processing contents of the most recent predetermined number of times of the image forming operations in the case where the driving torque detected by the torque detecting circuit **201** exceeds a predetermined value. That is, the control portion **200** is configured to be able to execute the lubricant supplying mode of supplying the lubricant to either one of the rubbing portion rB (first rubbing position) and the rubbing portion rd (second rubbing position).

The control portion **200** is capable of executing the full-color mode of forming an image by using the photoconductive drums **103***a* through **103***c*, i.e., the first image carriers, and the photoconductive drum **103***d*, i.e., the second image carrier, and the monochrome mode of forming an image by using only the photoconductive drum **103***d*. Then, the control portion **200** supplies the lubricant to the rubbing portion rd (second rubbing position) in the case where the execution rate of the full-color mode in the most recent predetermined number of times of the image forming operations is greater than a predetermined rate in the lubricant supplying mode. This arrangement makes it possible to supply the lubricant precisely to the required region.

As shown in FIG. **5** (see also FIG. **2**), the control portion **200** receives a job and starts to form an image in Step S**101**. Then, after finishing the image forming operation in Step S**102**, it is determined whether or not the job is left in Step S**103**. If the job is left, i.e., No in Step S**103** as a result, the control portion **200** returns to Step S**101** and continues to form images.

Meanwhile, if it is determined that the entire job has been finished (Yes in Step S**103**), the control portion **200** controls as follows. That is, the driving torque Tr of the Bk-ITB motor **1** driving the photoconductive drum **103** and the intermediate transfer belt **101** through the driving roller **110** is detected by the torque detecting circuit **201** in Step S**104**.

Then, the control portion **200** compares the driving torque Tr thus detected with the threshold value T_1 set in advance in Step S**105**. In a case where it is determined that the driving torque Tr is smaller than the threshold value T_1 as a result (Yes in Step S**105**), the control portion **200** stops the image forming apparatus **70**. Meanwhile, in a case where it is determined that the driving torque Tr is greater than the threshold value T_1 (No in Step S**105**), the control portion **200** determines whether or not the most recent color rate is 20% or more in Step S**106**.

In a case where the color rate is greater than 20%, i.e., Yes in Step S**106**, as a result, the control portion **200** supplies the toner belt formed in the image forming portion **109**Bk to the photoconductor cleaning blade **108***d* in Step S**107**. The driving torque Tr of the Bk-ITB motor **1** is detected further by the torque detecting circuit **201** in Step S**108**.

After detecting the driving torque Tr in Step S**108**, the control portion **200** determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**109**. When the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**109**, the control portion **200** stops the image forming apparatus **70**.

Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**109**, the control portion **200** supplies the toner belt also to the belt cleaning blade **102** in Step S**110**. Thus, in the lubricant supplying mode, the following performance is made after supplying the lubricant to either one of the rubbing portions rB (first rubbing position) and rd (second rubbing position). That is, in a case where the driving torque Tr detected by the torque detecting circuit **201** exceeds the threshold value T_1, the lubricant is supplied either the other one (the rubbing portion rB. This arrangement makes it possible to precisely supply the lubricant to the required region.

After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**111**. After detecting the driving torque Tr in Step S**111**, the control portion **200** determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**112**.

In a case where the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**112**, the control portion **200** stops the image forming apparatus **70**. In a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**112**, the control portion **200** stops the image forming apparatus **70** after displaying a message urging to replace the process cartridge of the image forming portion **109**Bk and the intermediate transfer belt **101** on the display **202** in Step S**113**.

Meanwhile, in a case where the most recent color rate is less than 20%, i.e., No in Step S**106**, the control portion **200** supplies the toner belt to the belt cleaning blade **102** in Step S**114**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**115**.

After detecting the driving torque Tr in Step S115, the control portion 200 determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S116. In a case where the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S116, the control portion 200 stops the image forming apparatus 70.

Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S116, the control portion 200 supplies the toner belt also to the photoconductor cleaning blade 108*d* in Step S117. After that, the control portion 200 detects the driving torque Tr of the Bk-ITB motor 1 by the torque detecting circuit 201 in Step S118.

After detecting the driving torque Tr in Step S118, the control portion 200 determines whether or not the driving torque Tr thus detected is smaller than the threshold value T1 in Step S119. In a case where the driving torque Tr is smaller than the threshold value T1, as a result, i.e., Yes in Step S119, the control portion 200 stops the image forming apparatus 70.

In a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S119, the control portion 200 controls as follows. That is, the control portion 200 stops the image forming apparatus 70 after displaying a message urging to replace the process cartridge of the image forming portion 109Bk and the intermediate transfer belt 101 on the display 202 in Step S120.

It is also possible to arrange such that the supply of the toner belt to the photoconductor cleaning blade 108*d* and the belt cleaning blade 102 and the detection of the driving torque Tr of the Bk-ITB motor 1 are repeated by a plurality of times before displaying the message in Steps S113 and S120.

As described above, the control portion 200 executes the lubricant supplying mode during the post-rotation time performed after finishing the inputted series of jobs, so that the lubricant supplying mode can be executed in a stage in which fluctuation of the torque is stabilized after finishing the process of scraping the transfer residual toner by the cleaning blades.

According to the present embodiment described above, it is possible to supply the toner belt while reducing the wasteful toner consumption by giving priority to the supply of toner to the photoconductor cleaning blade 108*d* and the belt cleaning blade 102 based on the most recent color rate. This arrangement makes it possible to efficiently suppress an occurrence of the chipping and turn-up of the blades.

Second Embodiment

Next, a second embodiment of the present invention will be explained with reference to FIGS. 2 and 6. It is noted that FIG. 6 is a flowchart concerning processes in supplying the toner belt in the present embodiment.

In the first embodiment described above, the control of the supply of the toner belt carried out by giving the priority to the photoconductor cleaning blade 108*d* and the belt cleaning blade 102 based on the most recent color rate has been explained. However, in the present embodiment, a type of the recording medium P (referred to as 'sheet type' hereinafter) used in a most recent predetermined number of times of the image forming operations performed in the image forming apparatus 70 is adopted as the criteria of the priority. That is, the control portion 200 of the present embodiment controls so as to supply the lubricant to either one of the rubbing portions rB (first rubbing position) and rd (second rubbing position) based on the type of the most recent predetermined number of recording media on which the toner images have been transferred from the intermediate transfer belt 101. This arrangement makes it possible to precisely supply the lubricant to the required region.

While the toner image formed on the intermediate transfer belt 101 is secondarily transferred to the recording medium P at the secondary transfer portion Ts, smoothness is different depending on the type of the sheet used at this time, an amount of the transfer residual toner left on the intermediate transfer belt 101 without being secondarily transferred differs. It is known in general that an amount of transfer residual toner is large in a type of sheet (first recording medium) whose smoothness is low and an amount of the transfer residual toner is small in a type of sheet (second recording medium) whose smoothness is higher than the first recording medium.

In a case where a thick sheet and a coated sheet whose smoothness is high are set as the sheet type, the toner tends to deplete at the rubbing portion rB between the belt cleaning blade 102 and the intermediate transfer belt 101 as compared to a case when a plain sheet and a recycled sheet whose smoothness is low are set as the sheet type. Then, the toner is supplied by giving the priority to the rubbing portion rd of the photoconductor cleaning blade 108*d* in the case where the plain and recycled sheets are more often used in the most recent image forming job. Meanwhile, the toner is supplied by giving the priority to the rubbing portion rB of the belt cleaning blade 102 in a case where the thick and coated sheets are more often used in the most recent image forming job.

Specifically, the control portion 200 determines the priority of the supply of the toner belt to the rubbing portions rB and rd based on a number of used thick and coated sheets in forming images on the most recent 100 sheets in a case where the driving torque Tr of the Bk-ITB motor 1 is greater than the threshold value T_1.

In the present embodiment, the priority is given to the rubbing portion rB of the belt cleaning blade 102 in a case where the number of used thick and coated sheets is more than 50 sheets and to the rubbing portion rd of the photoconductor cleaning blade 108*d* in a case where the number of used thick and coated sheets is less than 50 sheets. However, the present invention is noted limited to these specific numerical values and names of the sheets such as the thick and coated sheets.

Here, as shown in FIG. 6 (see also FIG. 2), the control portion 200 receives a job and starts to form an image in Step S201. Then, after finishing the image forming operation in Step S202, it is determined whether or not the job is left in Step S203. If the job is left, i.e., No in Step S203, as a result, the control portion 200 returns to Step S201 and continues to form an image.

Meanwhile, if it is determined that the entire job has been finished, i.e., Yes in Step S203, the control portion 200 detects the driving torque Tr of the Bk-ITB motor 1 commonly driving the photoconductive drum 103 and the intermediate transfer belt 101 by the torque detecting circuit 201 in Step S204.

Then, the control portion 200 compares the driving torque Tr thus detected with the threshold value T_1 set in advance in Step S205. In a case where it is determined that the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S205, the control portion 200 stops the image forming apparatus 70. Meanwhile, in a case where it is determined that the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S205, the control portion 200 determines whether or not the most recently used number of thick and coated sheets is more than 50 sheets in Step S206.

In a case where the number of used thick and coated sheets is more than 50 sheets, i.e., Yes in Step S206, the control portion 200 supplies the toner belt formed in the image forming portion 109Bk to the belt cleaning blade 102 in Step S207.

The driving torque Tr of the Bk-ITB motor **1** is detected further by the torque detecting circuit **201** in Step S**208**.

After detecting the driving torque Tr in Step S**208**, the control portion **200** determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**209**. In a case where the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**209**, the control portion **200** stops the image forming apparatus **70**.

Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**209**, the control portion **200** supplies the toner belt also to the photoconductor cleaning blade **108***d* in Step S**210**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**211**.

After detecting the driving torque Tr in Step S**211**, the control portion **200** determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**212**. In a case where the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**212**, the control portion **200** stops the image forming apparatus **70**. In a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**212**, the control portion **200** stops the image forming apparatus **70** after displaying a message urging to replace the process cartridge of the image forming portion **109**Bk and the intermediate transfer belt **101** on the display **202** in Step S**213**.

Meanwhile, in a case where the number of most recently used thick and coated sheets is less than 50 sheets, i.e., No in Step S**206**, the control portion **200** supplies the toner belt to the photoconductor cleaning blade **108***d* in Step S**214**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**215**.

After detecting the driving torque Tr in Step S**215**, the control portion **200** determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**216**. In a case where the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**216**, the control portion **200** stops the image forming apparatus **70**.

Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**216**, the control portion **200** supplies the toner belt also to the belt cleaning blade **102** in Step S**217**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**218**.

After detecting the driving torque Tr in Step S**218**, the control portion **200** determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**219**. In a case whether the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**219**, the control portion **200** stops the image forming apparatus **70**.

In a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**219**, the control portion **200** controls as follows. That is, the control portion **200** stops the image forming apparatus **70** after displaying a message urging to replace the process cartridge of the image forming portion **109**Bk and the intermediate transfer belt **101** on the display **202** in Step S**220**.

It is also possible to arrange such that the supply of the toner belt to the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** and the detection of the driving torque Tr of the Bk-ITB motor **1** are repeated by a plurality of times before displaying the message in Steps S**213** and S**220**.

According to the present embodiment described above, the priority is given to the supply of toner to the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** based on the type of the most recently used sheet. This arrangement makes it possible to supply the toner belt with economy and to suppress an occurrence of the chipping and turn-up of the blades efficiently.

Third Embodiment

Next, a third embodiment of the present invention will be explained with reference to FIGS. **2** and **7**. The present embodiment has a configuration of supplying the toner belt by combining the priority based on the most recent color rate of the first embodiment and the priority based on the most recently used type of sheet of the second embodiment. It is noted that FIG. **7** is a flowchart concerning processes in supplying the toner belt in the present embodiment.

Here, as shown in FIG. **7** (see also FIG. **2**), the control portion **200** receives a job and starts to form an image in Step S**301**. Then, after finishing the image forming operation in Step S**302**, it is determined whether or not the job is left in Step S**303**. If the job is left, i.e., No in Step S**303**, as a result, the control portion **200** returns to Step S**301** and continues to form images.

Meanwhile, if it is determined that the entire job has been finished, i.e., Yes in Step S**303**, the control portion **200** makes controls as follows. That is, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** commonly driving the photoconductive drum **103** and the intermediate transfer belt **101** through the driving roller **110** by the torque detecting circuit **201** in Step S**304**.

Then, the control portion **200** compares the driving torque Tr thus detected with the threshold value T_1 in Step S**305**. In a case where it is determined that the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**305**, the control portion **200** stops the image forming apparatus **70**. Meanwhile, in a case where it is determined that the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**305**, the control portion **200** determines whether or not the most recent color rate is more than 20% in Step S**306**.

In a case where the color rate is greater than 20%, i.e., Yes in Step S**306**, as a result, the control portion **200** supplies the toner belt formed in the image forming portion **109**Bk to the photoconductor cleaning blade **108***d* in Step S**307**. The driving torque Tr of the Bk-ITB motor **1** is detected further by the torque detecting circuit **201** in Step S**308**.

After detecting the driving torque Tr in Step S**308**, the control portion **200** determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**309**. When the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**309**, the control portion **200** stops the image forming apparatus **70**.

Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**309**, the control portion **200** supplies the toner belt also to the belt cleaning blade **102** in Step S**310**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**311**.

After detecting the driving torque Tr in Step S**311**, the control portion **200** determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**312**. In a case where the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**312**, the control portion **200** stops the image forming apparatus **70**. In a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**312**, the control portion **200** stops the image forming apparatus **70** after displaying a message urging to replace the process cartridge of the image

forming portion **109**Bk and the intermediate transfer belt **101** on the display **202** in Step S**313**.

In a case where the most recent color rate is lower than 20%, i.e., No in Step S**306**, the control portion **200** determines whether or not the number of most recently used thick and coated sheets is more than 50 sheets in Step S**314**. In case where it is determined that the number of used thick and coated sheets is less than 50 sheets, i.e., No in Step S**314**, the control portion **200** advances to the process from Step S**307**. Meanwhile, in a case where it is determined that the number of used thick and coated sheets is more than 50 sheets, i.e., Yes in Step S**314**, the process the control portion **200** advances to Step S**315**.

The control portion **200** supplies the toner belt to the belt cleaning blade **102** in Step S**315**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**316**.

Then, it is determined whether the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**317**. In a case where the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in **317**, the control portion **200** stops the image forming apparatus **70**. Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_1, No in Step S**317**, the control portion **200** supplies the toner belt also to the photoconductor cleaning blade **108***d* in Step S**318**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**319**.

After detecting the driving torque Tr in Step S**319**, the control portion **200** determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**320**. In a case where the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**320**, the control portion **200** stops the image forming apparatus **70**.

Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**320**, the control portion **200** as follows. That is the control portion **200** stops the image forming apparatus **70** after displaying a message urging to replace the process cartridge of the image forming portion **109**Bk and the intermediate transfer belt **101** on the display **202** in Step S**321**.

It is noted that an arrangement may be made such that the supply of the toner belt to the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** and the detection of the driving torque Tr of the Bk-ITB motor **1** are repeated by a plurality of times before displaying the message in Steps S**313** and S**321**.

The present embodiment described above makes it possible to supply the toner belt without wastefully consuming the toner by giving the priority to the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** based on the most recent color rate and the type of the used sheets. Thereby, it is possible to efficiently suppress an occurrence of the chipping and turn-up of the blades.

Next, a fourth embodiment of the present invention will be explained with reference to FIGS. **8**, **9** and **10**. The control of assuming the photoconductor cleaning blade **108***d* or the belt cleaning blade **102** to which the toner belt is to be supplied in priority based on the most recent color rate and the type of used sheets has been explained in the first, second and third embodiments. In the present embodiment, however, a method of separating a torque required for driving the photoconductive drum **103** and a torque required for driving the intermediate transfer belt **101** from the driving torque Tr of the Bk-ITB motor **1** will be explained.

As shown in FIGS. **8** and **9**, a clutch **2** is disposed between the photoconductive drum **103***d* (Bk drum) and the Bk-ITB motor **1** to make a configuration in which the intermediate transfer belt **101** can be solely driven in the present embodiment. Then, the photoconductive drums **103***a* (Y drum), **103***b* (M drum), **103***c* (C drum) are driven by the common color motor **75** in the same manner with the first through third embodiment.

That is, as shown in FIG. **8** which is a block diagram of a control system executing the supply of the toner belt, the torque detecting circuit **201**, the Bk-ITB motor **1** and the display **202** are connected to the control portion **200**. The image forming portion **109**Bk also includes the photoconductive drum **103***d* and the photoconductor cleaning blade **108***d*. The intermediate transfer belt **101** includes the driving roller **110** and the belt cleaning blade **102**. Then, the clutch **2** is disposed between a transmission path of the photoconductive drum **103***d* of the image forming portion **109**Bk and the Bk-ITB motor **1**.

That is, as shown in FIG. **9**, the photoconductive drums **103***a* (yellow photoconductive drum), **103***b* (magenta photoconductive drum), and **103***c* (cyan photoconductive drum) are rotationally driven by the common color motor **75**. The photoconductive drum **103***d* (Bk drum) and the intermediate transfer belt **101** (the driving roller **110**) are also commonly rotationally driven by the Bk-ITB motor **1**. It is noted that the Bk-ITB motor **1** composes a driving source to commonly rotationally drive the intermediate transfer belt **101** and the photoconductive drum **103***d* (second image carrier). Then, this arrangement makes it possible to rotationally drive only the intermediate transfer belt **101** by disconnecting the photoconductive drum **103***d* by turning OFF the clutch **2**. At this time, in a case of solely driving the intermediate transfer belt **101**, the primary transfer rollers **107***a* through **107***d* corresponding respectively to the photoconductive drums **103***a* through **103***d* and the stretch rollers **113** and **114** are moved to a separate position separating from the intermediate transfer belt **101** by a mechanism not shown.

This arrangement makes it possible to solely drive the intermediate transfer belt **101** by switching the clutch **2** while keeping a simple structure that permits cutting of costs. It is noted that the clutch **2** can be disposed not only between the photoconductive drum **103***d* and the Bk-ITB motor **1** but also between the intermediate transfer belt **101** and the Bk-ITB motor **1**, and substantially the same effect can be obtained also in such a case.

According to the present embodiment, the above mentioned arrangement makes it possible to drive the intermediate transfer belt **101** without sliding with the photoconductive drums **103***a* through **103***d*. The driving torque Tr of the Bk-ITB motor **1** is detected by the torque detecting circuit **201** in the state in which the intermediate transfer belt **101** is solely driven by disconnecting the photoconductive drum **103***d* by turning OFF the clutch **2**. Thereby, it is possible to precisely determine whether it is necessary to supply the toner belt to the rubbing portion rB between the belt cleaning blade **102** and the intermediate transfer belt **101**.

The clutch **2** connects/disconnects the transmission of the drive from the Bk-ITB motor **1** (driving source) to the photoconductive drum **103***d* (second image carrier) in the present embodiment. In a case where the driving torque (driving load) detected by the torque detecting circuit **201** is greater than the threshold value T_1 (first predetermined value), the control portion **200** makes controls as follows. That is, the control portion **200** detects the driving torque of the Bk-ITB motor **1** again by the torque detecting circuit **201** in the state in which the photoconductive drum **103***d* is disconnected from the Bk-ITB motor **1** by the clutch **2**. Based on the result, the lubricant supplying mode of supplying the lubricant to either

one of the rubbing portions rB and rd is executed. This arrangement makes it possible to supply the lubricant more precisely.

In the present embodiment, a threshold value T_2 is set with respect to the driving torque Tr of the Bk-ITB motor **1** in solely driving the intermediate transfer belt **101** in the same manner in commonly driving the photoconductive drum **103***d* and the intermediate transfer belt **101**.

That is, as described later, the control portion **200** of the present embodiment compares the driving torque detected again by the torque detecting circuit **201** in the state in which the photoconductive drum **103***d* is not driven with the threshold value T2 (second predetermined value) which is smaller than the threshold value T_1. Based on that, the control portion **200** supplies the lubricant to either one of the rubbing portions rd (second rubbing position) and rB (first rubbing position). Then, in a case where the driving torque detected again is less than the threshold value T2 (second predetermined value), the control portion **200** supplies the lubricant to the rubbing portion rd (second rubbing position). This arrangement makes it possible to supply the lubricant more precisely.

In a case where the driving torque detected again is greater than the threshold value T_2 (second predetermined value), the control portion **200** supplies the lubricant to the rubbing portion rB and then performs as follows in the condition in which the photoconductive drum **103***d* is connected to the Bk-ITB motor **1** by the clutch **2**. That is, the control portion **200** detects the driving torque of the Bk-ITB motor **1** further by the torque detecting circuit **201** and in a case where the driving torque thus detected is greater than the threshold value T_1 (first predetermined value), the control portion **200** supplies the lubricant to the rubbing portion rd (second rubbing position). This arrangement makes it possible to supply the lubricant more precisely. It is noted the control portion **200** executes the lubricant supplying mode during the post-rotation time after finishing a series of inputted jobs.

The inventors et al. found that the driving torque turned out as follows in a case where toner and external additive, i.e., lubricant, stationarily exists at the rubbing portion rd between the belt cleaning blade **102** and the intermediate transfer belt **101**.

That is, the driving torque Tr of the Bk-ITB motor **1** in solely driving the intermediate transfer belt **101** saturated around 0.017 to 0.02 kgf·m (0.166 to 0.196 N/m). The inventors et al. also found that the turn-up of the belt cleaning blade **102** tends to frequently occur when the driving torque Tr of the Bk-ITB motor **1** in solely driving the intermediate transfer belt **101** increases more than 0.03 kgf·m (0.294 N/m).

Then, the threshold value T_2 of the driving torque Tr of the Bk-ITB motor **1** in solely driving the intermediate transfer belt **101** will be set at 0.025 kgf·m (0.245 N/m) by considering also chipping of the belt cleaning blade **102** in the present embodiment. However, the present invention is not limited to these specific numerical values.

Next, the process of supplying the toner belt of the present embodiment will be explained with reference to FIG. **10**. It is noted that FIG. **10** is a flowchart concerning the process for supplying the toner belt in the present embodiment.

Here, as shown in FIG. **10** (see also FIGS. **8** and **9**), the control portion **200** receives a job and starts to form an image in Step S**401**. Then, after finishing the image forming operation in Step S**402**, it is determined whether or not the job is left in Step S**403**. If the job is left, i.e., No in Step S**403**, as a result, the control portion **200** returns to Step S**401** and continues to form an image.

Meanwhile, if it is determined that the entire job has been finished, i.e., Yes in Step S**403**, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** commonly driving the photoconductive drum **103** and the intermediate transfer belt **101** by the torque detecting circuit **201** in Step S**404**.

Then, the control portion **200** compares the driving torque Tr thus detected with the threshold value T_1 set in advance in Step S**405**. In a case where it is determined that the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**405**, the control portion **200** stops the image forming apparatus **70**. Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**405**, the control portion **200** turns OFF the clutch **2** (disconnection state) and solely drives the intermediate transfer belt **101** in Step S**406**. Then, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**407**.

In a case where the driving torque Tr is smaller than the threshold value T2, i.e., Yes in Step S**408**, as a result, the control portion **200** turns ON the clutch **2** (connection state) and supplies the toner belt formed in the image forming portion **109**Bk to the photoconductor cleaning blade **108***d* in Step S**410**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** further by the torque detecting circuit **201** in Step S**411**.

In a case where the driving torque Tr is smaller than the threshold value T_1, i.e., Yes in Step S**412**, as a result, the control portion **200** stops the image forming apparatus **70**. Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**412**, the control portion **200** stops the image forming apparatus **70** after displaying a message urging to replace the process cartridge of the image forming portion **109**Bk and the intermediate transfer belt **101** on the display **202** in Step S**413**.

Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_2, i.e., No in Step S**408**, the control portion **200** turns ON the clutch **2** (connection state) in Step S**414** and supplies the toner belt to the belt cleaning blade **102** in Step S**415**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**416**.

After detecting the driving torque Tr in Step S**416**, the control portion **200** determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**417**. When the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**417**, the control portion **200** stops the image forming apparatus **70**.

Meanwhile, in a case whether the driving torque Tr is greater than the threshold value T_1, No in Step S**417**, the control portion **200** supplies the toner belt also to the photoconductor cleaning blade **108***d* in Step S**418**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**419**.

After detecting the driving torque Tr in Step S**419**, the control portion **200** determines whether or not the driving torque Tr thus detected is smaller than the threshold value T_1 in Step S**420**. In a case where the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**420**, the control portion **200** stops the image forming apparatus **70**.

Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**420**, the control portion **200** stops the image forming apparatus **70** after displaying a message urging to replace the process cartridge of the image forming portion **109**Bk and the intermediate transfer belt **101** on the display **202** in Step S**421**.

It is noted that an arrangement may be made such that the supply of the toner belt to the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** and the detection of the

driving torque Tr of the Bk-ITB motor **1** are repeated by a plurality of times before displaying the message in Steps S**413** and S**421**.

The present embodiment described above makes it possible to supply the toner belt without wastefully consuming the toner by providing the torque detecting mode of solely driving the intermediate transfer belt **101**. Thereby, it is possible to efficiently suppress an occurrence of the chipping and turn-up of the blades.

Fifth Embodiment

A fifth embodiment of the present invention will be explained with reference to FIGS. **2** and **11**. The toner belt supplying sequence has been carried out as the lubricant supplying mode during the post-rotation time after finishing a job in the first through fourth embodiments described above. However, in a case of continuously printing a large number of images which consume less toner, there is a possibility that the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** require the supply of the toner belt during the continuous job.

Then, in the present embodiment, in a case where a continuous job of printing more than a predetermined number of sheets is to be carried out, the job is interrupted once at a predetermined number of sheets to detect the driving torque Tr of the Bk-ITB motor **1**. That is, the control portion **200** of the present embodiment executes the lubricant supplying mode by interrupting the process when the number of image formed sheets reaches the predetermined number while executing a series of inputted jobs. This control can be carried out also in the first through fifth embodiments described above in the same manner.

In this control, the supply of the toner belt is carried out in a case where the driving torque Tr thus detected exceeds the threshold value. At this time, the toner belt is supplied by giving the priority to the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** in the same manner with that of the first through fourth embodiments (that is, based on the color rate and the type of the recording medium).

While the job is interrupted when the number of continuously image formed sheets is 100 sheets to detect the driving torque Tr of the Bk-ITB motor **1** in the present embodiment, the present invention is not limited these specific numerical values.

The present embodiment will be explained by exemplifying the case of executing the supply of the toner belt by giving the priority to the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** based on the most recent color rate which has been explained in the first embodiment will be explained with reference to FIGS. **2** and **11**. It is noted that FIG. **11** is a flowchart in supplying the toner belt according to the present embodiment.

Here, as shown in FIG. **11** (see also FIG. **2**), the control portion **200** receives a job and starts to form an image in Step S**501**. Ina case where a number of consecutive image formed sheets is less than 100 sheets (No in Step S**502**), the control portion **200** confirms whether or not the job is left after finishing the current image forming job in Step S**503** in Step S**504**. If the job is left (No in Step S**504**) as a result, the control portion **200** returns to Step S**501** and continues to form images. Meanwhile, if the entire job has been finished (Yes in S**504**), the image forming apparatus **70** is halted.

If the number of the consecutively image formed sheets reaches 100 sheets, i.e., Yes in Step S**502**, the control portion **200** finishes to form images in Step S**505**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** driving the photoconductive drum **103** and the intermediate transfer belt **101** by the torque detecting circuit **201** in Step S**506**.

Then, the control portion **200** compares the driving torque Tr thus detected with the threshold value T_1 in Step S**507**. In a case where it is determined that the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**507**, the control portion **200** resets the number of consecutive image formed sheets in Step S**523** and advances to Step S**504**. Meanwhile, in a case where it is determined that the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**507**, the control portion **200** determines whether or not the most recent color rate is more than 20% in Step S**508**.

In a case where the color rate is greater than 20%, i.e., Yes in Step S**508**, as a result, the control portion **200** supplies the toner belt formed in the image forming portion **109**Bk to the photoconductor cleaning blade **108***d* in Step S**509**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**510**.

Then, the control portion **200** compares the driving torque Tr thus detected with the threshold value T_1 in Step S**511**. In a case where it is determined that the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**511**, the control portion **200** resets the consecutive image formed sheets in Step S**523** and advances to Step S**504**. Meanwhile, in a case where it is determined that the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**511**, the control portion **200** supplies the toner belt also to the belt cleaning blade **102** in Step S**512**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**513**.

The control portion **200** compares the driving torque Tr thus detected with the threshold value T1 in Step S**514**. When it is determined that the driving torque Tr is smaller than the threshold value T1 as a result, i.e., Yes in Step S**514**, the control portion **200** resets the consecutive image formed sheets in Step S**523** and advances to Step S**504**. Meanwhile in a case where it is determined that the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**514**, the control portion **200** stops the image forming apparatus **70** after displaying a message urging to relates the image forming portion **109**Bk and the intermediate transfer belt **101** on the display **202** in Step S**515**.

In a case where the most recent color rate is less than 20%, i.e., No in Step S**508**, the control portion **200** supplies the toner belt to the belt cleaning blade **102** in Step S**516**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**517**.

The control portion **200** compares the driving torque Tr thus detected with the threshold value T_1 in Step S**518**. In a case where the driving torque Tr is smaller than the threshold value T_1 as a result, i.e., Yes in Step S**518**, the control portion **200** resets the number of consecutively image formed sheets in Step S**523** and advances to Step S**504**. Meanwhile, in a case where the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**518**, the control portion **200** supplies the toner belt also to the photoconductor cleaning blade **108***d* in Step S**519**. After that, the control portion **200** detects the driving torque Tr of the Bk-ITB motor **1** by the torque detecting circuit **201** in Step S**520**.

Then, the control portion **200** compares whether or not the driving torque Tr thus detected with the threshold value T_1 in Step S**521**. In a case where the control portion determines that the driving torque Tr is smaller than the threshold value T_1 as

a result, i.e., Yes in Step S**521**, the control portion **200** advances to Step S**523**. Meanwhile, in a case where the control portion **200** determines that the driving torque Tr is greater than the threshold value T_1, i.e., No in Step S**521**, the control portion **200** stops the image forming apparatus **70** after displaying a message urging to replace the process cartridge of the image forming portion **109**Bk and the intermediate transfer belt **101** on the display **202** in Step S**522**.

It is noted that an arrangement may be made such that the supply of the toner belt to the photoconductor cleaning blade **108***d* and the belt cleaning blade **102** and the detection of the driving torque Tr of the Bk-ITB motor **1** are repeated by a plurality of times before displaying the message in Steps S**515** and S**522**. Still further, the toner belt may be supplied in the same manner even when the driving torque Tr thus detected exceeds the threshold value T_1 by detecting the driving torque Tr of the Bk-ITB motor **1** during the post-rotation time after finishing the entire job.

According to the present embodiment described above, it is possible to supply the toner belt while reducing the wasteful toner consumption by setting the torque detecting mode of detecting the driving torque Tr of the Bk-ITB motor **1** during the consecutive jobs. This arrangement makes it possible to efficiently suppress an occurrence of the chipping and turn-up of the blades.

Other Embodiments

Embodiments of the present invention can also be realized by a computer of a system or apparatus that reads out and executes computer executable instructions recorded on a storage medium (e.g., non-transitory computer-readable storage medium) to perform the functions of one or more of the above-described embodiment(s) of the present invention, and by a method performed by the computer of the system or apparatus by, for example, reading out and executing the computer executable instructions from the storage medium to perform the functions of one or more of the above-described embodiment (s). The computer may comprise one or more of a central processing unit (CPU), micro processing unit (MPU), or other circuitry, and may include a network of separate computers or separate computer processors. The computer executable instructions may be provided to the computer, for example, from a network or the storage medium. The storage medium may include, for example, one or more of a hard disk, a random-access memory (RAM), a read only memory (ROM), a storage of distributed computing systems, an optical disk (such as a compact disc (CD), digital versatile disc (DVD), or Blu-ray Disc (BD)™), a flash memory device, a memory card, and the like.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

This application claims the benefit of Japanese Patent Application No 0.2013-151084, filed on Jul. 19, 2013 which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. An image forming apparatus comprising:

first and second rotatably supported image carriers;

an intermediate transfer belt rotatably conveying a toner image transferred thereto;

a driving source rotationally driving both the intermediate transfer belt and the second image carrier;

a first cleaning blade rubbing the intermediate transfer belt at a first rubbing position;

a second cleaning blade rubbing the second image carrier at a second rubbing position;

a lubricant supplying portion configured to be able to supply lubricant to the first or second rubbing position;

a load detecting portion configured to detect a driving load of the driving source; and

a control portion configured to execute a lubricant supplying mode of supplying lubricant to either one of the first and second rubbing positions on a basis of processing contents of a most recent predetermined number of times of image forming operations in a case where the driving load detected by the load detecting portion exceeds a predetermined value,

wherein the control portion is configured to execute a full-color mode of forming an image by using the first and second image carriers and a monochrome mode of forming an image by using only the second image carrier, and supplies the lubricant to the second rubbing position in a case where a most recent execution rate of the full-color mode exceeds a predetermined rate in the lubricant supplying mode.

2. The image forming apparatus according to claim **1**, wherein the control portion supplies the lubricant to either one of the first and second rubbing positions on a basis of a most recent type of a predetermined number of recording media on which toner images have been transferred from the intermediate transfer belt.

3. The image forming apparatus according to claim **1**, wherein the control portion is configured to transfer a toner image from the intermediate transfer belt to a first recording medium and a second recording medium whose smoothness is higher than that of the first recording medium in the full-color and monochrome modes, and

the control portion supplies the lubricant to the second rubbing position in a case where a recording medium used in forming a most recent predetermined number of times of image forming operations is not the second recording medium, regardless whether or not an execution rate of the most recent full-color mode exceeds a predetermined rate, in the lubricant supplying mode.

4. The image forming apparatus according to claim **1**, wherein the lubricant is supplied also to the other rubbing position in a case where the driving load detected by the load detecting portion is greater than a predetermined value even if the lubricant is supplied to either one of the first and second rubbing positions in the lubricant supplying mode.

5. The image forming apparatus according to claim **1**, wherein the control portion executes the lubricant supplying mode during a post-rotation performed after finishing an inputted series of jobs.

6. The image forming apparatus according to claim **1**, wherein the control portion executes the lubricant supplying mode by interrupting a process of a series of inputted jobs when a number of image formed recording media reaches a predetermined number.

7. The image forming apparatus according to claim **1**, further comprising:

a first primary transfer portion transferring the toner image formed on the first image carrier to the intermediate transfer belt;

a second primary transfer portion transferring the toner image formed on the second image carrier to the intermediate transfer belt; and

a secondary transfer portion transferring the toner images which have been transferred from the first and second image carriers to the intermediate transfer belt to the recording media,

wherein the lubricant supplying portion includes a developing unit developing an electrostatic latent image formed on the second image carrier as a toner image, and

wherein the control portion applies, in the lubricant supplying mode, voltage with polarity inverse to that of a case where the toner image is transferred from the intermediate transfer belt to the recording medium to the secondary transfer portion in supplying the lubricant to the first rubbing position, and applies voltage with polarity inverse to that of a case where the toner image is transferred from the second image carrier to the intermediate transfer belt to the second primary transfer portion in supplying the lubricant to the second rubbing position.

8. An image forming apparatus comprising:

first and second rotatably supported image carriers;

an intermediate transfer belt rotatably conveying a toner image transferred thereto;

a driving source rotationally driving both the intermediate transfer belt and the second image carrier;

a clutch portion connecting/disconnecting the transmission of the drive from the driving source to either one of the intermediate transfer belt and the second image carrier;

a first cleaning blade rubbing the intermediate transfer belt at a first rubbing position;

a second cleaning blade rubbing the second image carrier at a second rubbing position;

a lubricant supplying portion configured to be able to supply lubricant to the first or second rubbing position;

a load detecting portion configured to detect a driving load of the driving source; and

a control portion configured to execute a lubricant supplying mode of, in a case where the driving load detected by the load detecting portion exceeds a first predetermined value, supplying the lubricant to either one of the first and second rubbing positions on a basis of a result obtained by detecting the driving load of the driving source again by the load detecting portion in a state in which either one of the intermediate transfer belt and the second image carrier is disconnected from the driving source by the clutch portion.

9. The image forming apparatus according to claim **8**, wherein the control portion supplies the lubricant to either one of the first and second rubbing positions on a basis of a comparison made by comparing the driving load detected again by the load detecting portion in the state in which the second image carrier is not driven with a second predetermined value which is smaller than the first predetermined value.

10. The image forming apparatus according to claim **9**, wherein the control portion supplies the lubricant to the rubbing position where the member on a side in which the transmission of power is disconnected by the clutch portion is formed among the first and second rubbing positions in a case where the driving load detected again is less than the second predetermined value.

11. The image forming apparatus according to claim **9**, wherein the control portion supplies the lubricant to the first rubbing position in a case where the driving load detected again is greater than the second predetermined value, detects the driving load of the driving source further by the load detecting portion in the state in which the second image carrier is connected with the driving source by the clutch portion, and supplies the lubricant to the second rubbing position in a case where the driving load detected further is greater than the first predetermined value.

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